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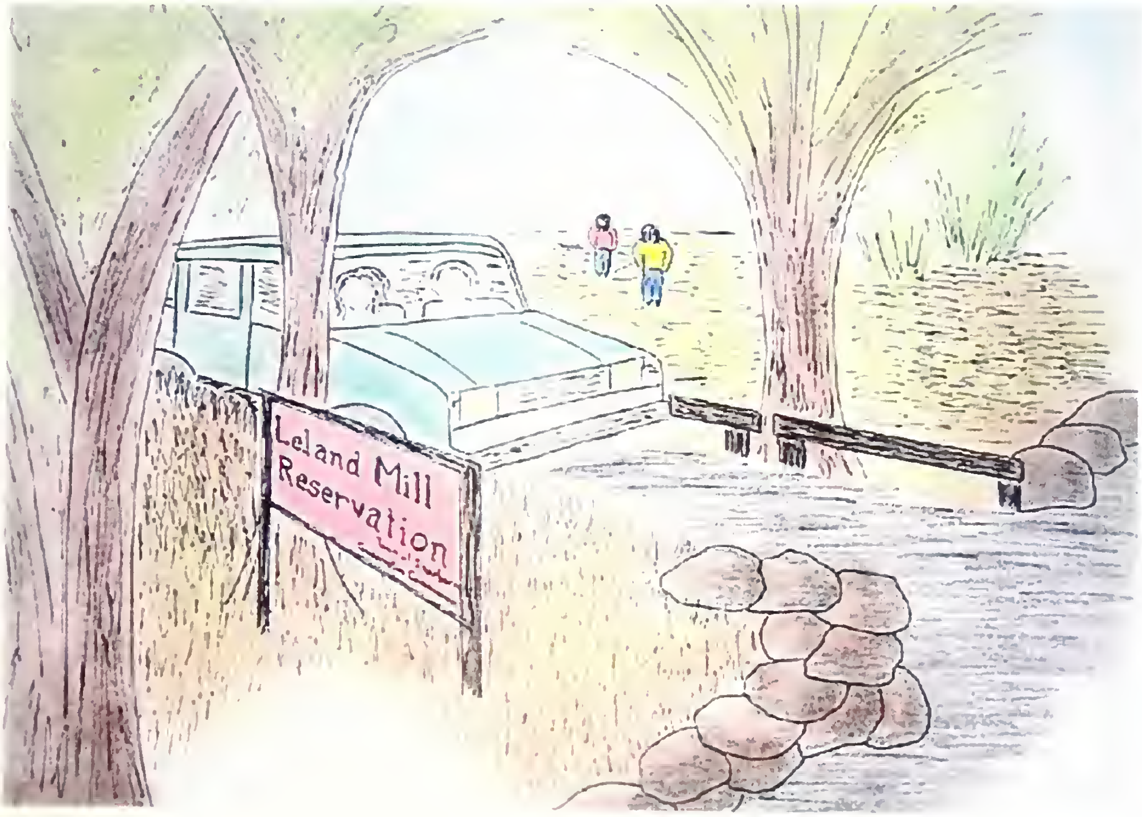

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Thurza Campbell

Radcliffe Seminars

Independent Project

May, 1999

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Elizabeth Johnston

From: Thurza Campbell <jimthurza@gmail.com>
Sent: Tuesday, March 10, 2015 4:57 PM
To: 'Elizabeth Johnston'
Subject: RE: Library & Commonwealth digitalization project

I would be honored to have it included.
Thurza

From: Elizabeth Johnston [mailto:Elizabeth.Johnston2@comcast.net]
Sent: Tuesday, March 10, 2015 4:55 PM
To: jimthurza@gmail.com
Subject: Library & Commonwealth digitalization project

Dear Thurza,

The Library is preparing to participate in the "Digital Commonwealth" project located at https://www.digitalcommonwealth.org/

Today, representatives from the Boston Public Library, who are managing the digitization of Massachusetts' city and town archives and local histories, met with Margo Powicki, Betsy Johnson, Ed Perry and I to evaluate Sherborn's resources of historic and local interest.

One of the items I chose as a candidate for digitization is your "Leland Mill Reservation: History Remembered/Nature Enjoyed – a Restorative Vision", which we have cataloged for the Library's "Sherborn Shelf" as a physical volume.

I am writing to ask your permission to include your work as a possible contribution to the Sherborn Collection in the Digital Commonwealth Catalog. In your abstract, you state, "I believe that the Leland Mill Reservation is such a unique public treasure that it must be shared." By permitting the Library to recommend the digitization of your research in a state-wide catalog, I believe you will be reaching many others to share this public treasure.

Given your permission, the BPL digitization team will return to Sherborn within a few months to transport to Boston the approved selections for the digitization project. The hard copies will be returned to Sherborn in approximately 8 weeks.

Thank you for your consideration, Thurza.

Your librarian,
Elizabeth Johnston

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https://archive.org/details/lelandmillreserv00camp

Abstract

This paper sets forth a vision for the restoration of a conservation property in the Town of Sherborn, Massachusetts. The Leland Mill Reservation is a thirty two acre parcel containing significant historical sites and a thriving wildlife habitat. There are ruins of mill operations on this site. Two mill dams impound water that create two ponds, which are homes to wildlife. The Reservation is presently closed to the public because of security gates, rampant poison ivy and fallen trees. Public funds are inadequate to properly administer and maintain the Reservation. My research explored the industrial history of the site, analyzed the existing conditions of the property, and then developed a Master Plan for restoration. The goal of the restoration is to make this property accessible to the public for historical education and passive recreation, while enhancing it as a lush wildlife habitat. I have included realistic implementation steps as part of the restoration vision, because I believe that the Leland Mill Reservation is such a unique public treasure that it must be shared.

Dedication

to the Power

which created the earth and gave us
responsibility for the stewardship of it.

Acknowledgments

Many loved ones and friends supported me in this endeavor. The initial impetus came with reading of *New Passages,* a gift from a daugher-in-law, which encouraged me to look at myself in midlife. My entire family encouraged my decision to shift gears and become a student again. My friend, Dave Tiedman told me about the Radcliffe program, certain that I would love it. The instructors at the Seminars each give so much of themselves, but I extend special gratitude to Kate Cardamone. Finally, I thank my husband Jim. Thirty-six years ago I typed his thesis. With all of the support both technical and emotional he as given me, I will now owe him eternally!

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E. DEM Request Forms for Jurisdictional Inspection of a Dam

F. DEM Request Forms for Dam Repair Work

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Leland Mill Reservation:
History Remembered/Nature Enjoyed:
A Restorative Vision

Introduction

The Leland Mill Reservation is a unique Cultural Landscape[1] in the Town of Sherborn, Massachusetts. This isolated sanctuary could become an attractive site for passive recreation, reflection and historic education while remaining a diverse wildlife habitat if its landscape were designed to include rehabilitation of its cultural elements. This paper will first delineate the history of the property from colonial times to the present. The second section will detail the Master Plan for the rehabilitation of this Cultural Landscape. The final section will outline administrative processes that should be followed in order for the Leland Mill Reservation to become and then remain an accessible site for passive recreation, reflection and historic education, while remaining a diverse wildlife habitat.

I: History

Leland Mill Reservation is a 32-acre site owned by the Town of Sherborn and administered by the Conservation Commission. Prior to the town's purchase in 1978, this parcel was part of property owned by the Leland family for over 300 years. The property is located in the southwest quadrant of the town north of Mill St., near the junction of Mill St. and Hollis St. On the property are two mill ponds which have been created by dams, as well as the foundation ruins of the millworks. *See Figures 1-4.*

---

[1] Charles A. Birnbaum, *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes,* (Washington, DC: U.S. Department of the Interior National Park Service Cultural Resource Stewardship and Partnerships Heritage Preservation Services Historic Landscape Initiative, 1996),48-88.

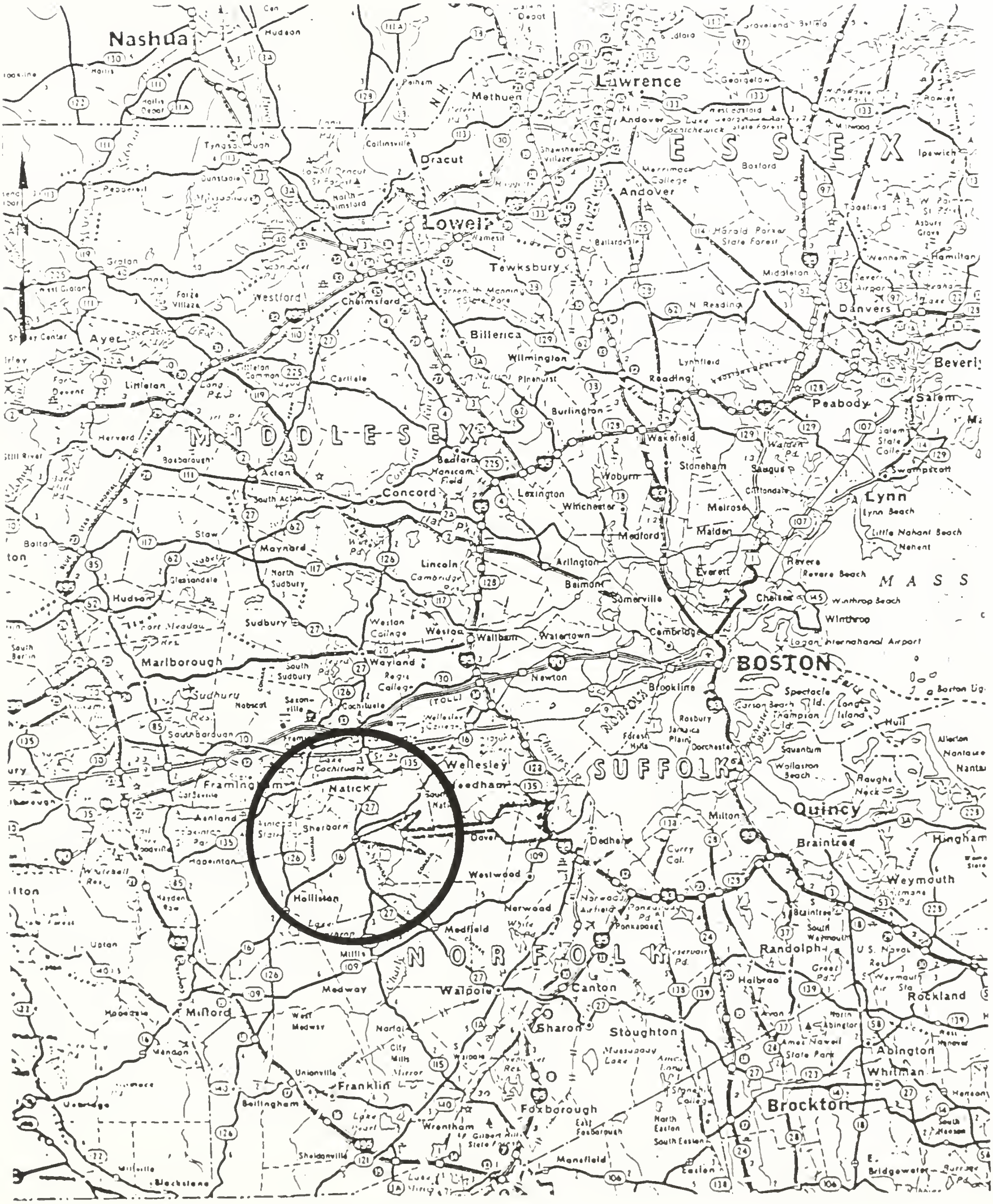


Fig. 1. Locus of Boston Area

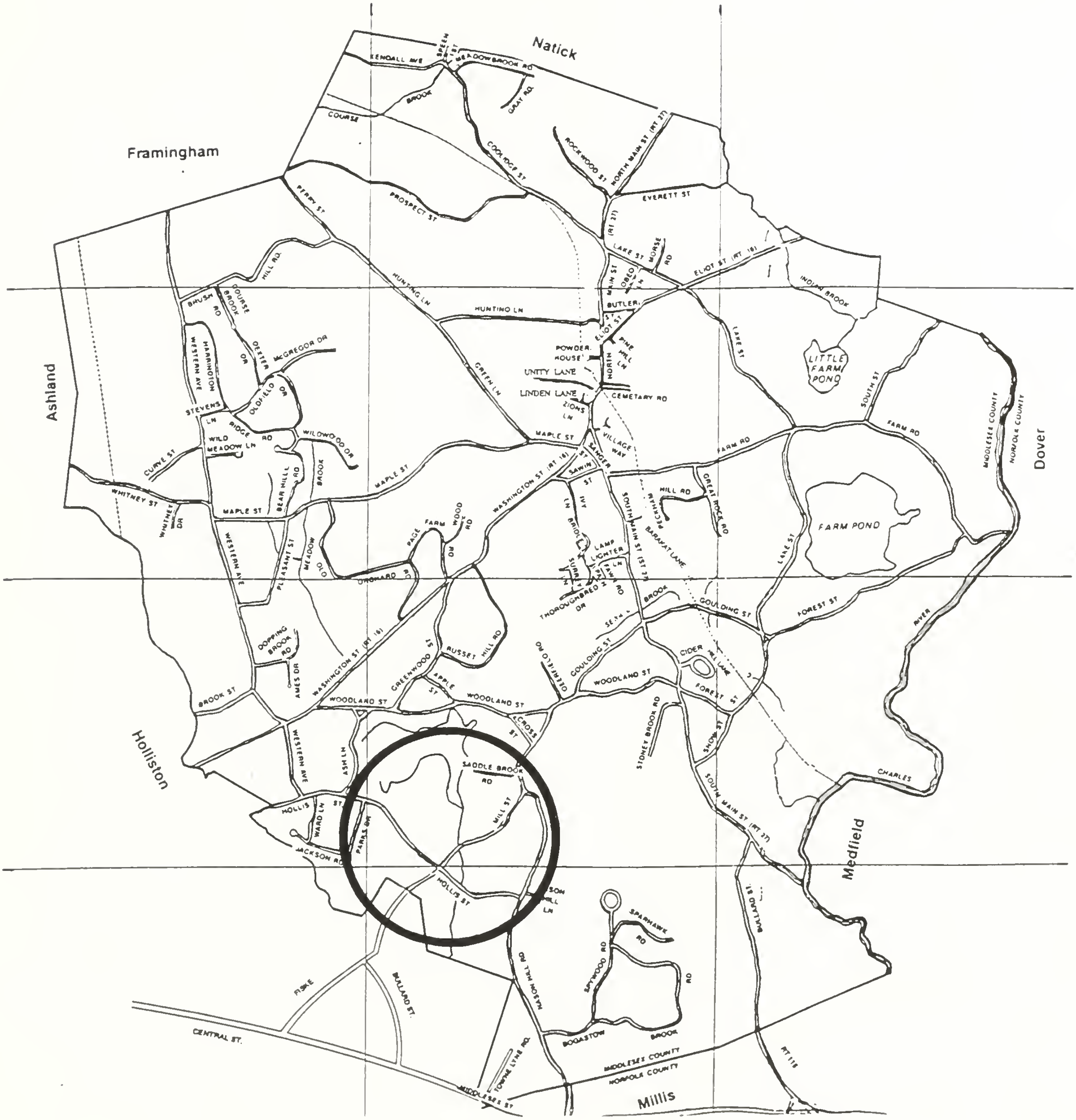


Fig. 2. Locus of the Town of Sherborn

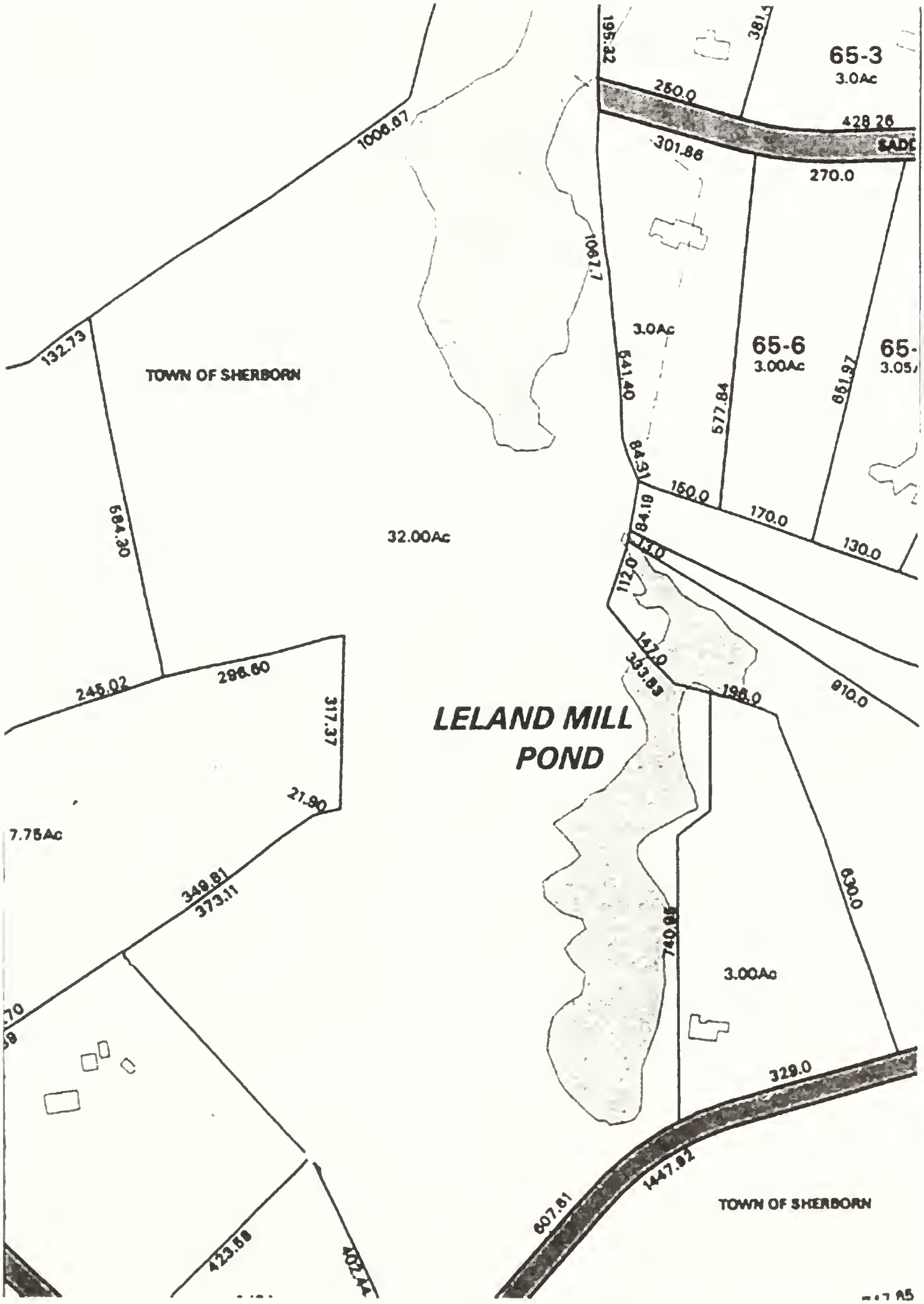


Fig. 3. Town of Sherborn Assessors' Map

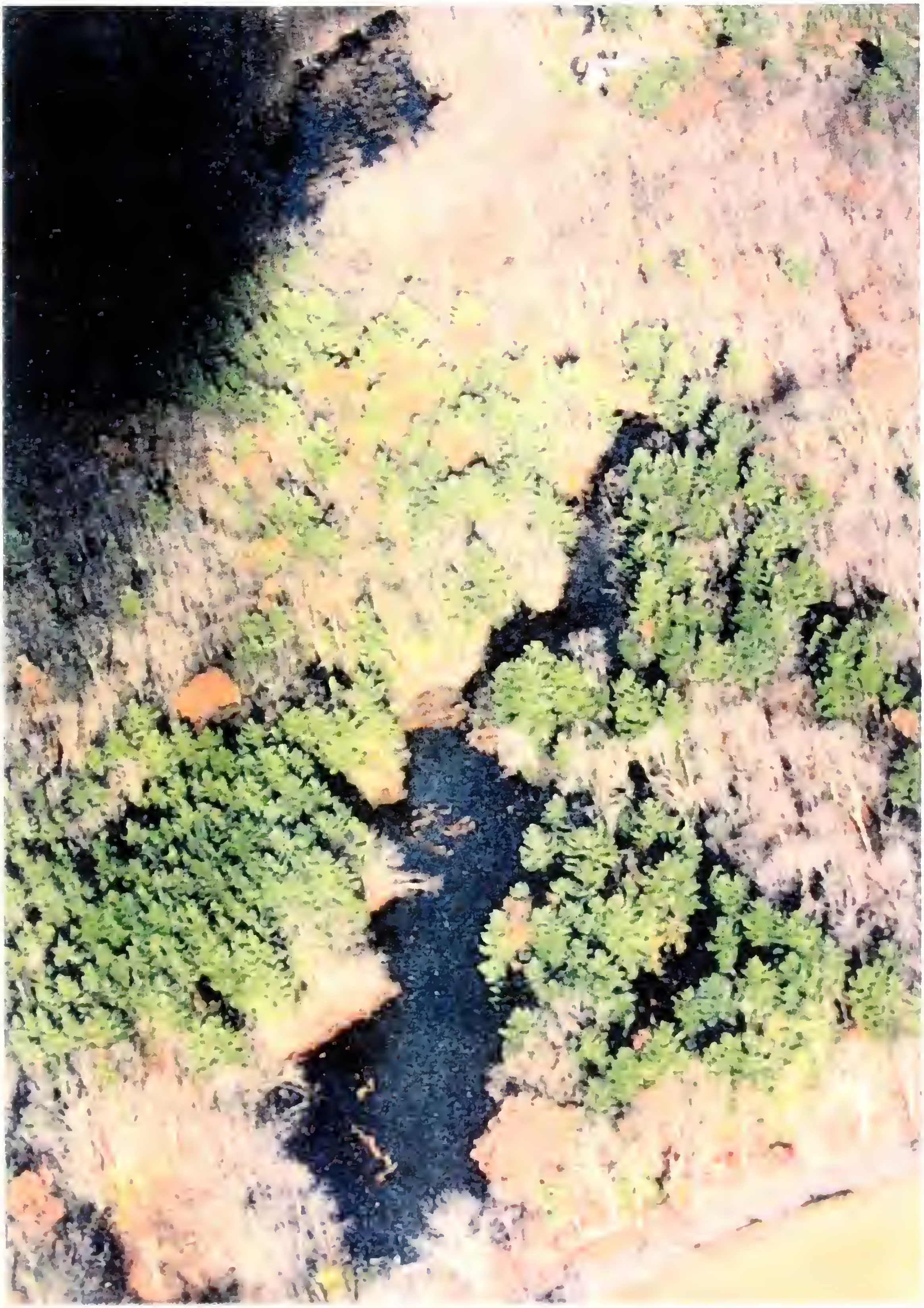


Fig. 4. Aerial of the Leland Mill Reservation

Prior to the 17th century, the glaciated coastal plain west of Massachusetts Bay was home to a community of Native Americans. During the 17th century the Massachusetts Bay Colony began expanding beyond Boston, dislocating the Native Americans. The earliest highways for the colonists' expansion were the rivers that emptied into the Bay in Boston. The Charles River, flowing into Boston from the west provided a means for colonists to establish Boggestow, the settlement beside the Charles River upstream from Natick, which was settled in 1652 and became the Town of Sherborn in 1674. Brown Meadow Brook, one of the tributaries of the Charles flowed through the land that the Henry Leland purchased from his brother-in-law, Thomas Holbrook, in 1666.[2] The Lelands farmed and conducted mill operations on their land for over 300 years, until descendents sold a portion of their holdings to the Town in 1978. Stone walls, defining some of the property lines, which now wind through the woods, once edged fields and pastures. *See Figure 5.* The old cart path, which once transported materials to and from the mills, is now a favorite trail for hikers and riders. *See Figure 6.*

Ruins of the upper dams with mill foundations and the oft'-repaired lower dam with mill foundations are all that remain of the milling enterprise. *See Figures 7-12.* Archaeologist Leonard Loparto from the Massachusetts Historical Commission recommends that the Town apply to have this archaeological site included in its register. Inclusion in the state register of archaeological sites would protect the site in perpetuity. *See Appendix A for all application forms.* Saw and grist milling were a vital component of rural New England in the 18th and 19th centuries. Milling was a seasonal sideline for farmers, who supplied their communities with a much-needed service. The Leland mill operations were an important local industry for many years.

---

[2] Anne Carr Shaughnessy, *The History of Sherborn.* (Sherborn: The 300th Anniversary Committee, 1974), 7.

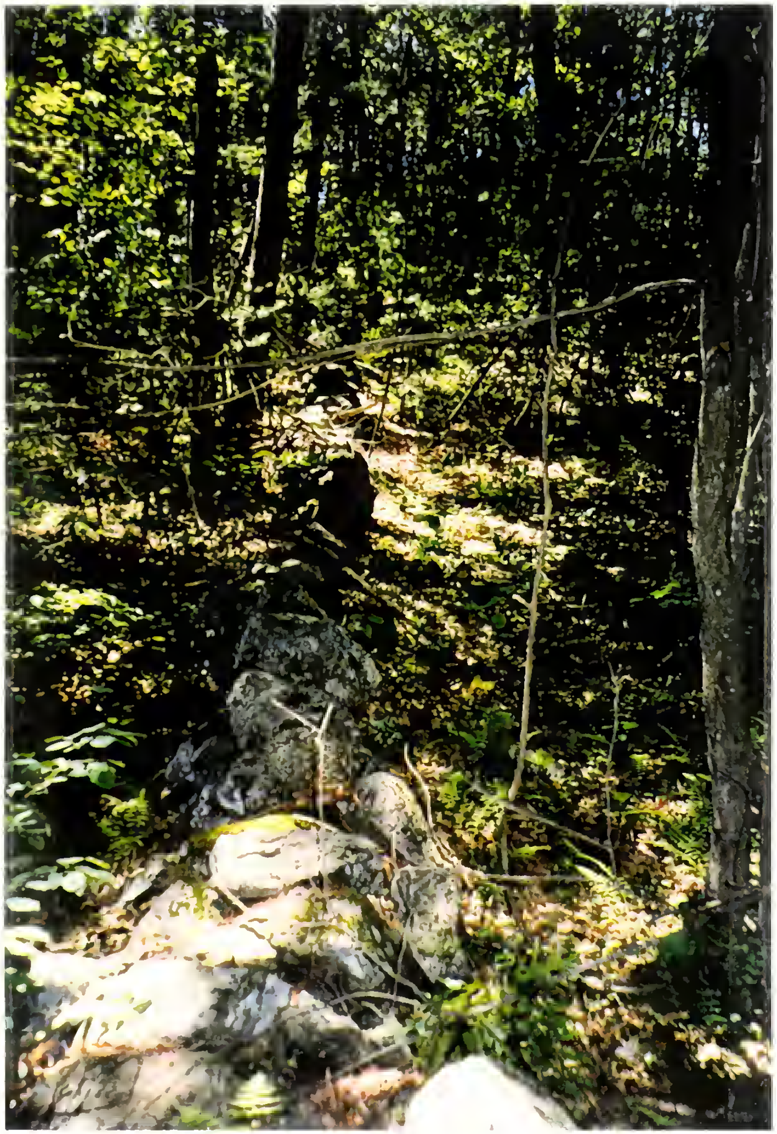


Fig. 5. Stone Walls Define the Property Lines

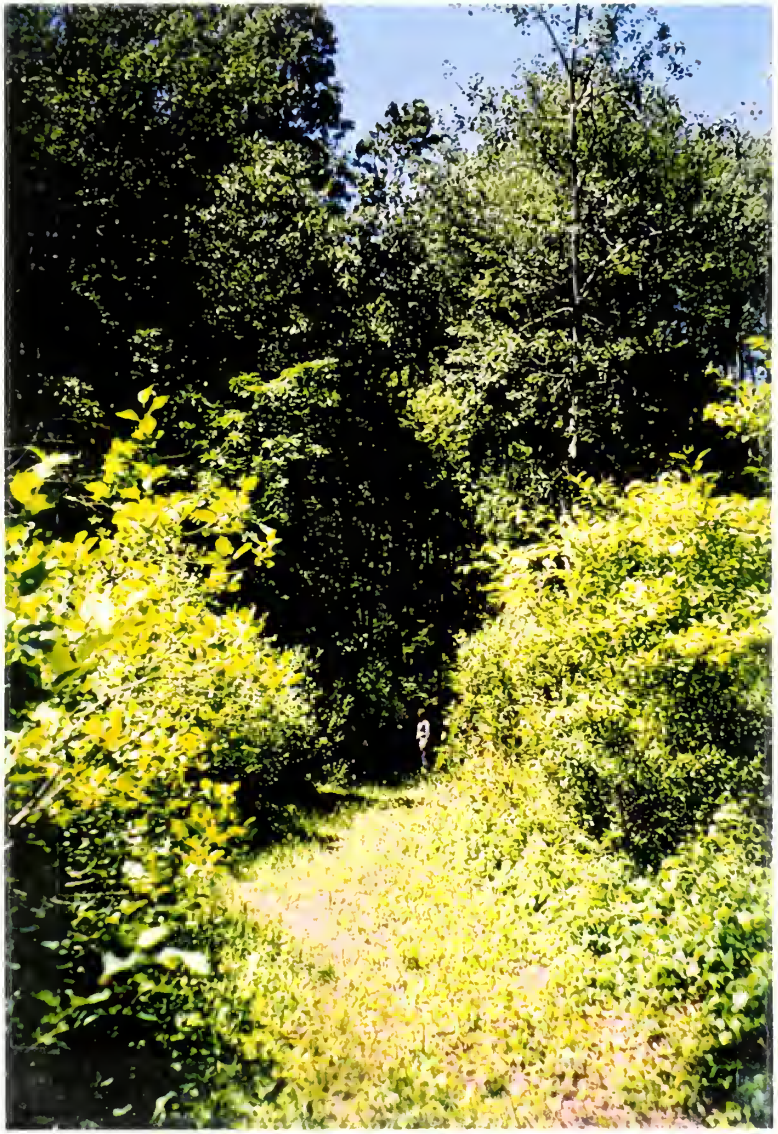


Fig. 6. The Old Cart Path

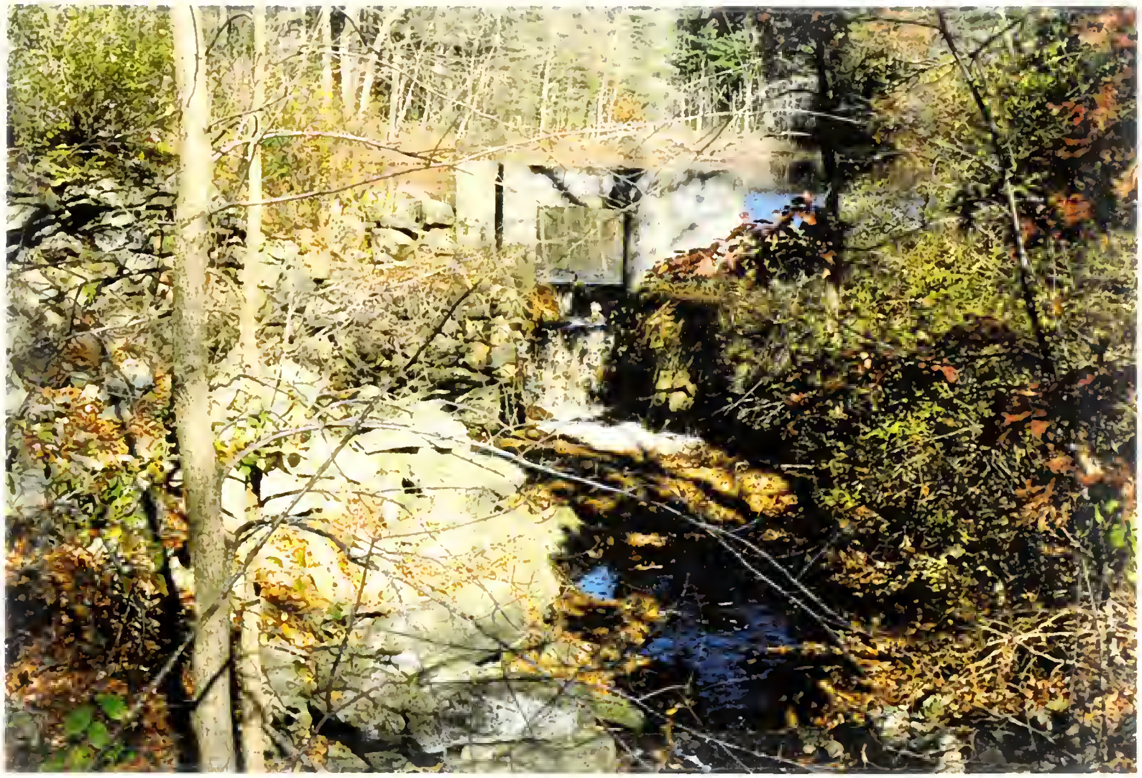


Fig. 7. The Lower Dam Today

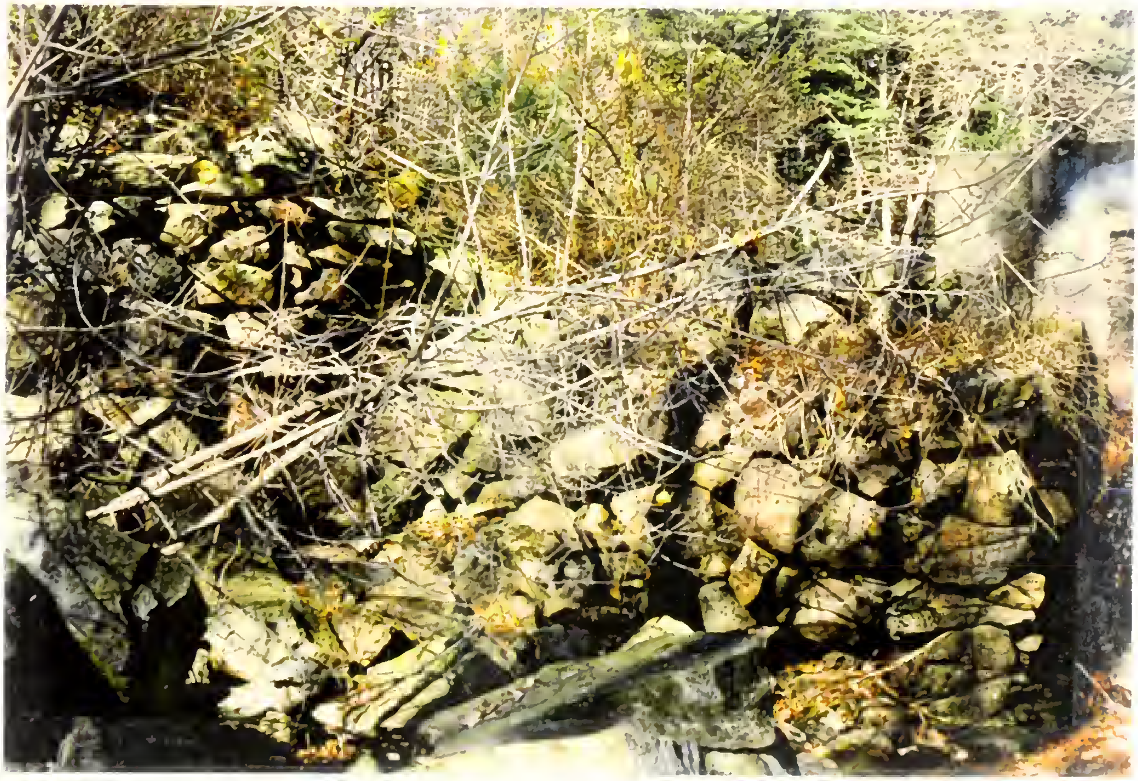


Fig. 8. The Lower Mill Foundation Ruins Today

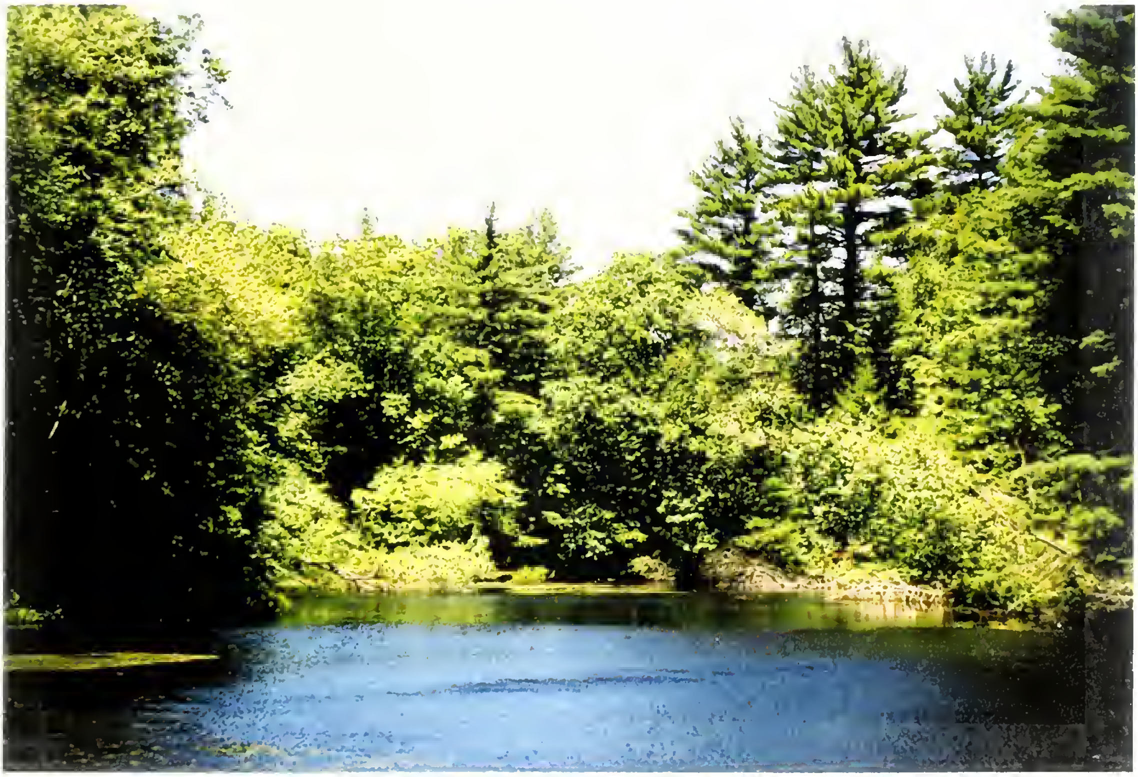


Fig. 9. The Lower Mill Pond Today

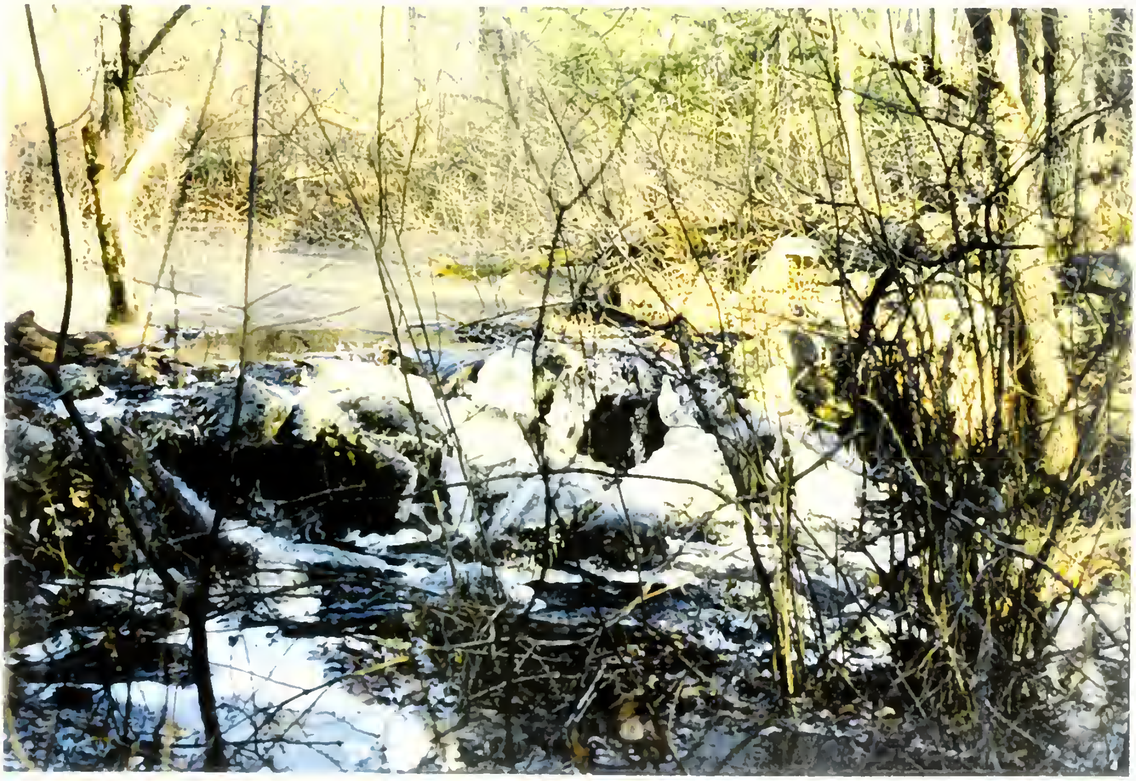


Fig. 10. The Upper Dam Today

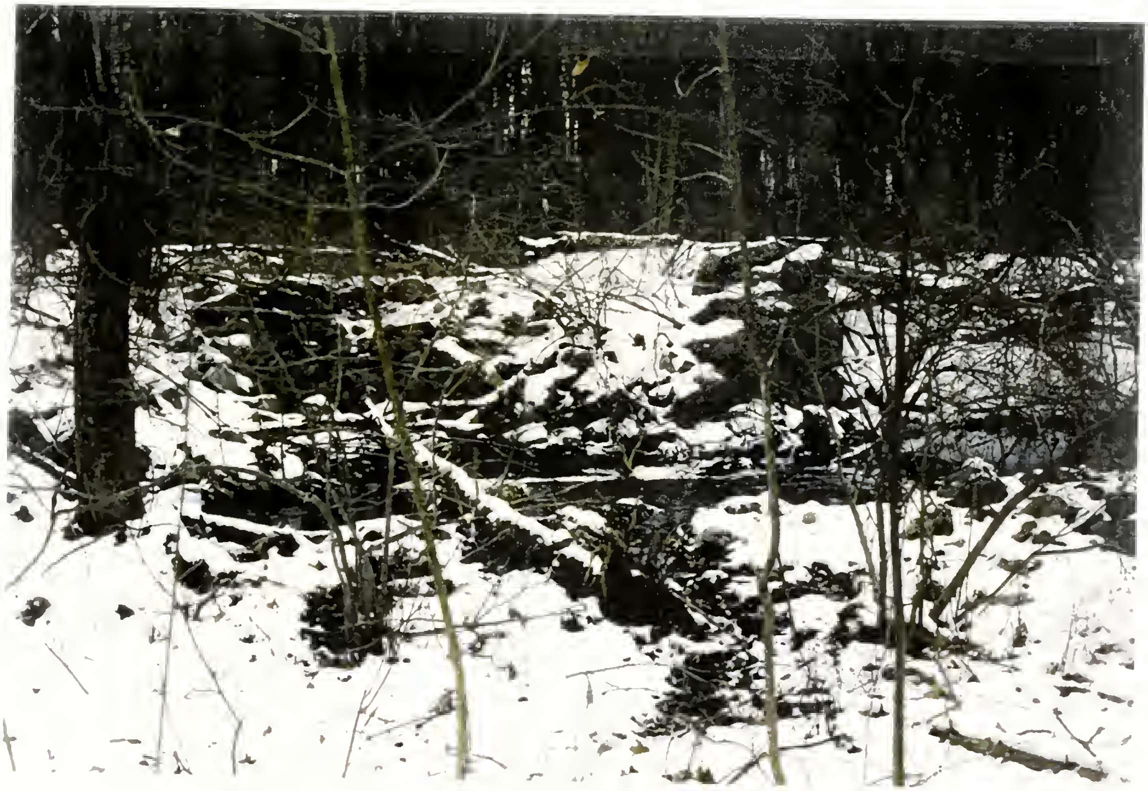


Fig. 11. The Upper Mill Foundations Today

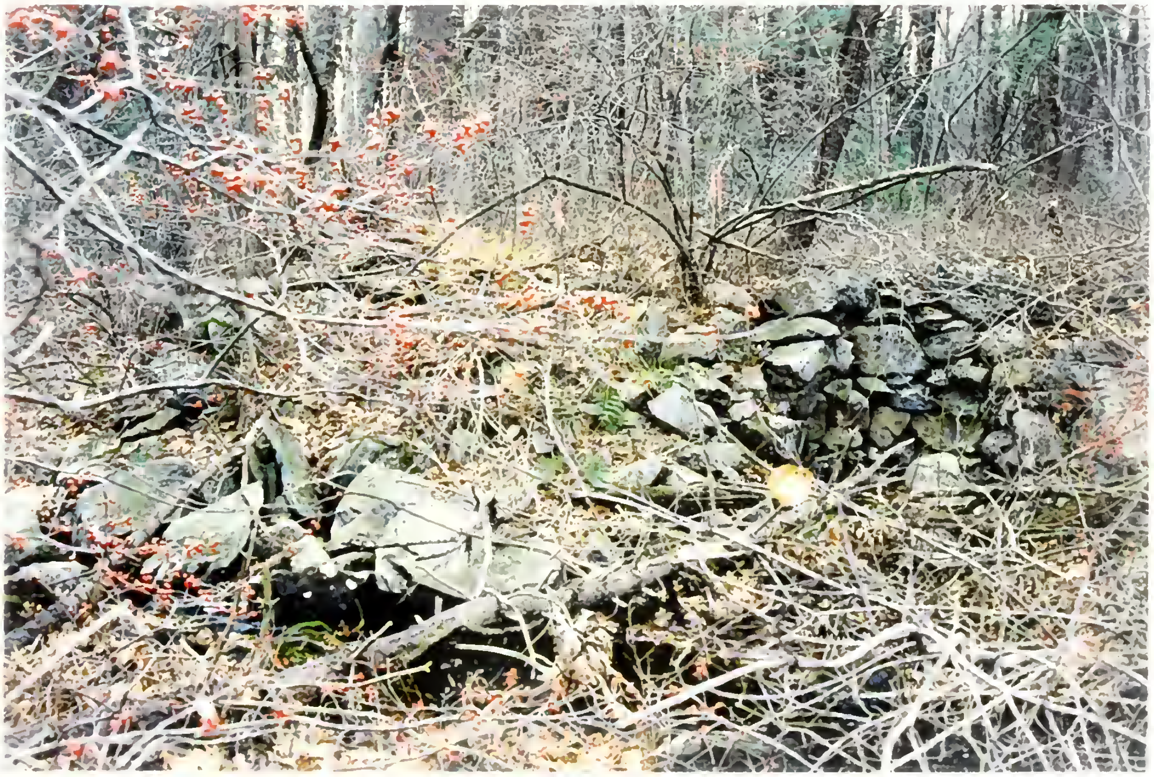


Fig. 12. The Power Transfer Structure Today

Research is incomplete regarding the history of the upper dams. [3] The upper dams probably date from the 18th century. Alex Barker, who manufactured trunnels there, built the upper mill, according to one source.[4] The upper mill foundation, which abuts the remnant of the middle dam contains a distinctive semi-circular power transfer foundation. Most of the stones from the western side of the middle dam were probably removed and used to build the lower dam, a common practice in the early 19th century.[5] *See Figure13.*

---

[3] The author of this dissertation makes clear that extensive archaeological explorations and research of dam/mill systems which were constructed in small streams in a wide geographic area are necessary to correctly interpret ruins. The water containment systems and mill ruins on the Leland site appear to be similar to systems she studied in Sturbridge and Stockbridge. Such extensive explorations as would be necessary to definitively establish the exact dates and industrial archaeology of the Leland ruins would be beyond the scope of this design project. Martha Blanchard Lance, *The Fathers Lived in the Forests: Their Children Lived off Them; Rural New England Sawmilling and the Timber Trade, 1730-1870* (Ann Arbor: UMI Dissertation Services, 1993).

[4] Anne Carr Shaughnessy, *A Guide to Sherborn* (Sherborn: The 300th Anniversary Committee, 1974), 145.

[5] Leonard Loparto, State Archaeologist/Preservation Planner,site visit, March 11, 1999.

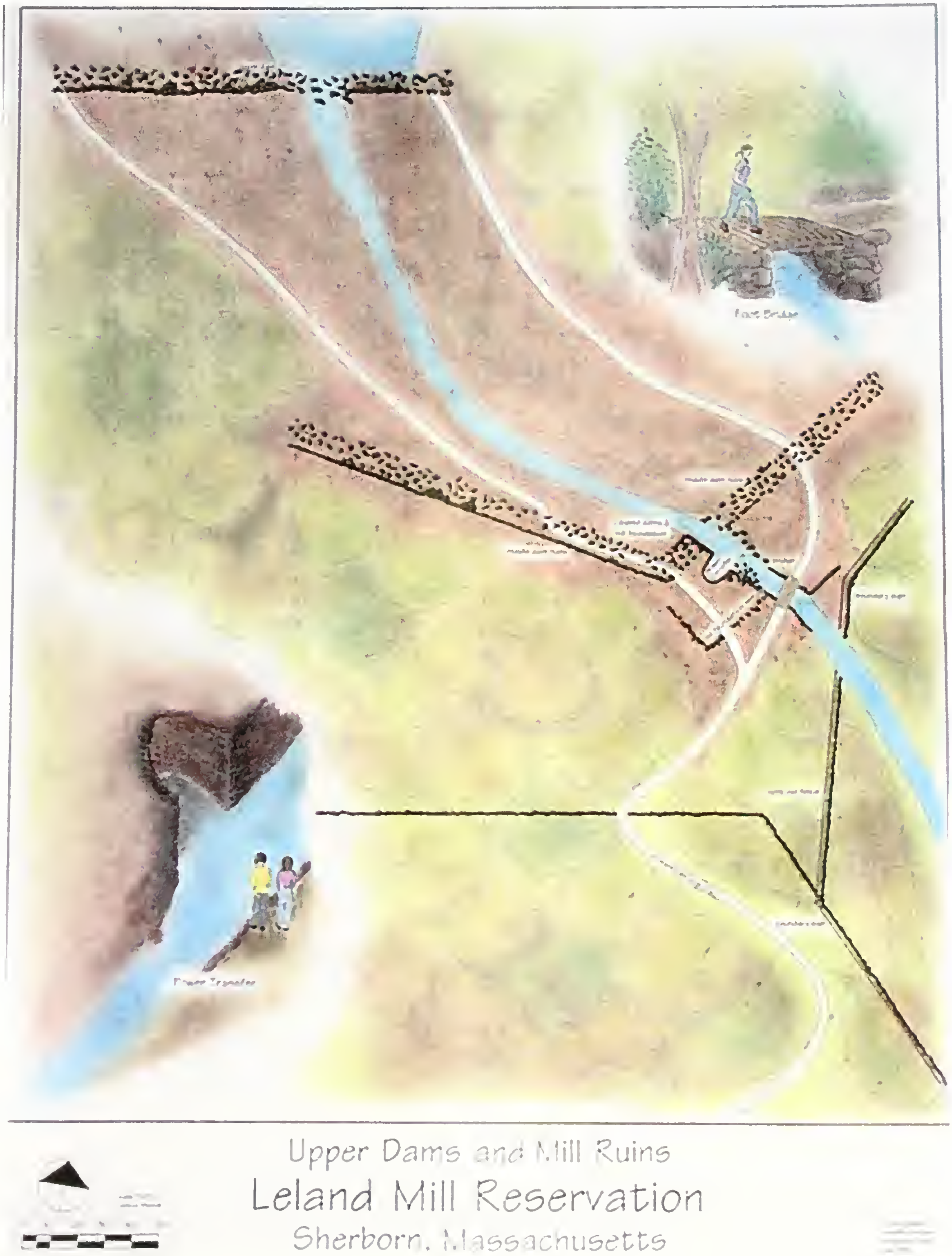


Fig. 13. The Upper Dams and Mill Foundations

The lower dam was built by the Lelands following a hurricane in 1815, which felled so many trees in the surrounding area, that the raw materials for a mill were plentiful. Brown Meadow Brook had its greatest fall in town at this location, and a dam in some form has been here ever since. *See Figures 14-17.* In the early 19th century, the written guidebook for building a dam and sawmill was Oliver Miller's *The Young Mill-wright and Miller's Guide*, first published in 1795. Existent technology in the early 19th century meant that an up-and-down sawmill could have been designed. The first sawmill erected at the lower site would have been based on Miller's plans (*See Figure 18*) or a variation thereof.[6] Portions of the lower dam washed out in 1922, damaging the mill, forcing it to close.[7] All that remains today of the lower mill are portions of the stone foundation. *See Figure 19.*

---

[6] .The Historical American Buildings Survey (Survey #NH-31, Call # HABS, NH.7-BOWMIL V-1)stored at the Library of Congress contains detailed, complete architectural plans of an up-and-down sawmill which was located in Bow, NH, which was a variation of the Evans plan. A mill following these plans has been reconstructed at Sturbridge Village. These HABS plans are located in Appendix B.

[7] Faith Tiberio, from a taped interview with *Jim Leland,* 9th generation Leland, May, 1973.(Sherborn Historical Society, 1973).

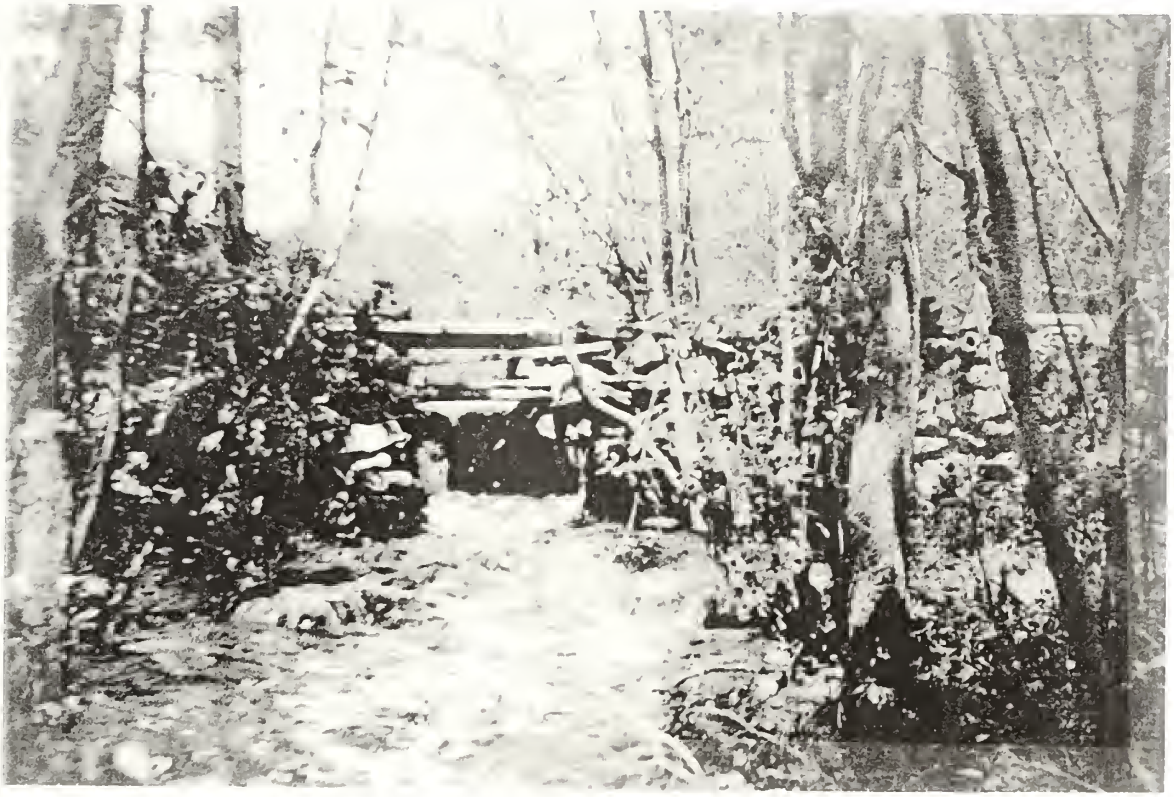


Fig. 14. The Lower Dam Before 1920. (Sherborn Historical Society)

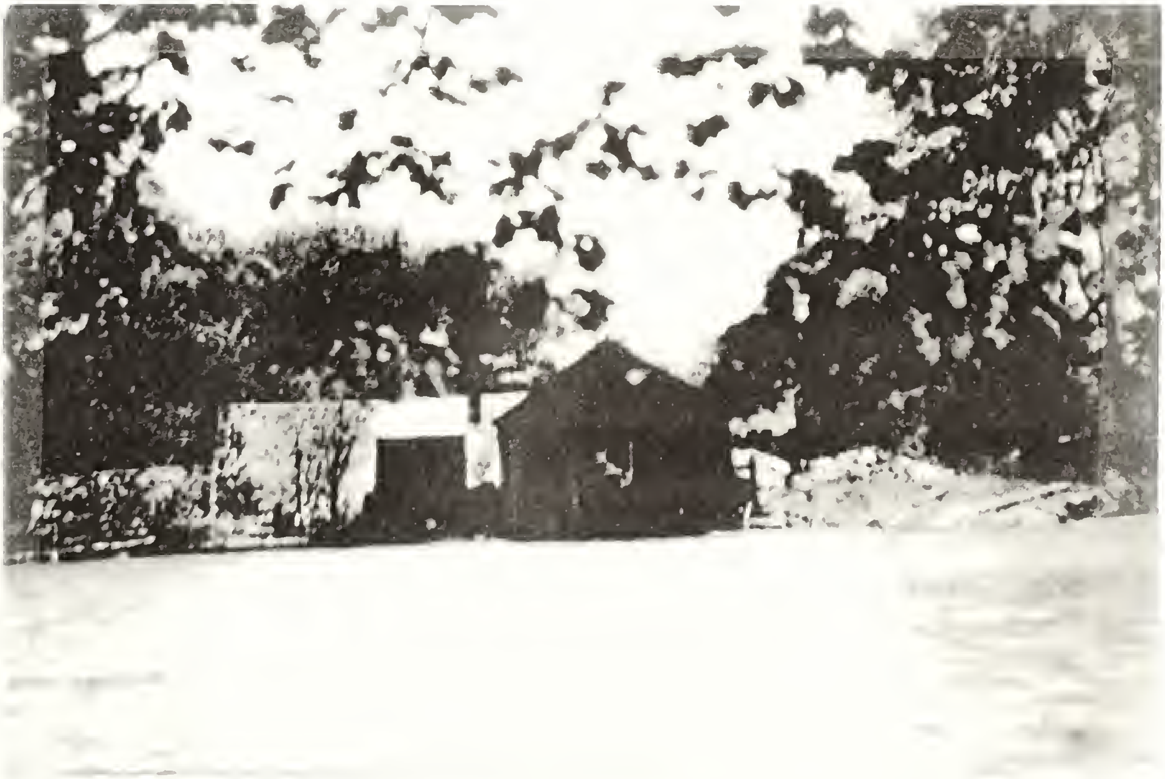


Fig. 15. The Lower Mill Before 1920. (Sherborn Historical Society)

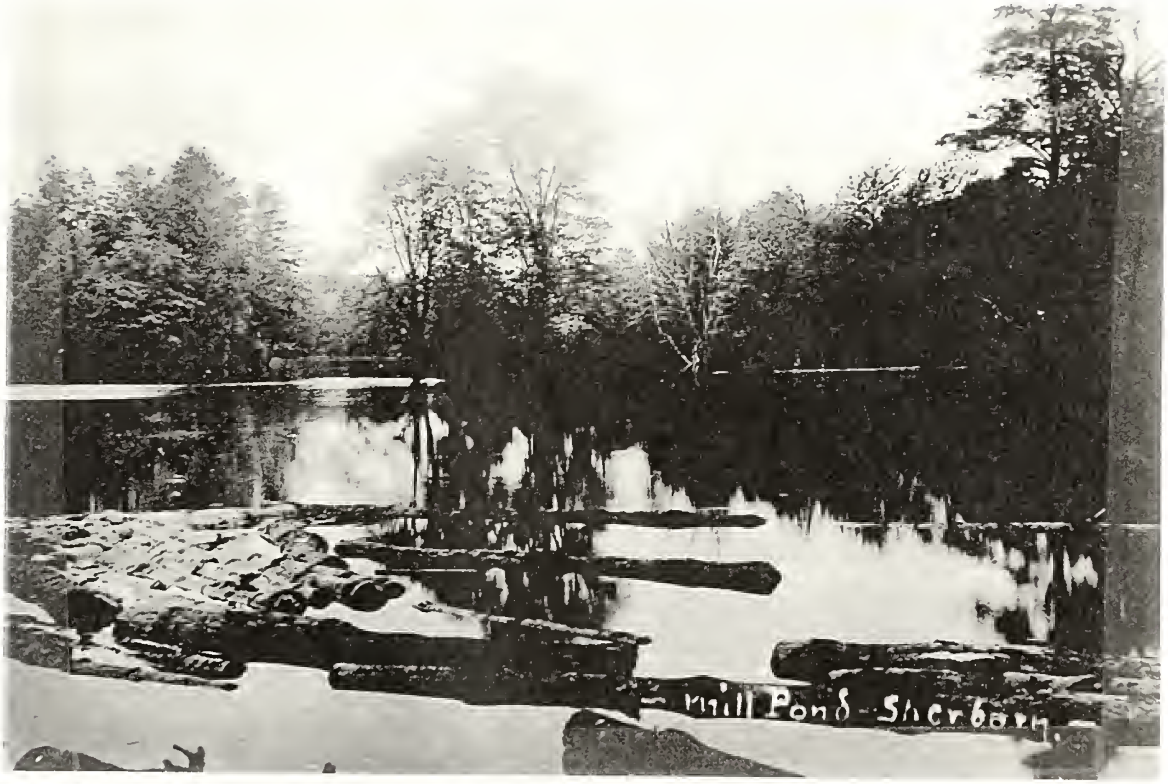


Fig. 16. The Mill Pond Before 1920. (Sherborn Historical Society)

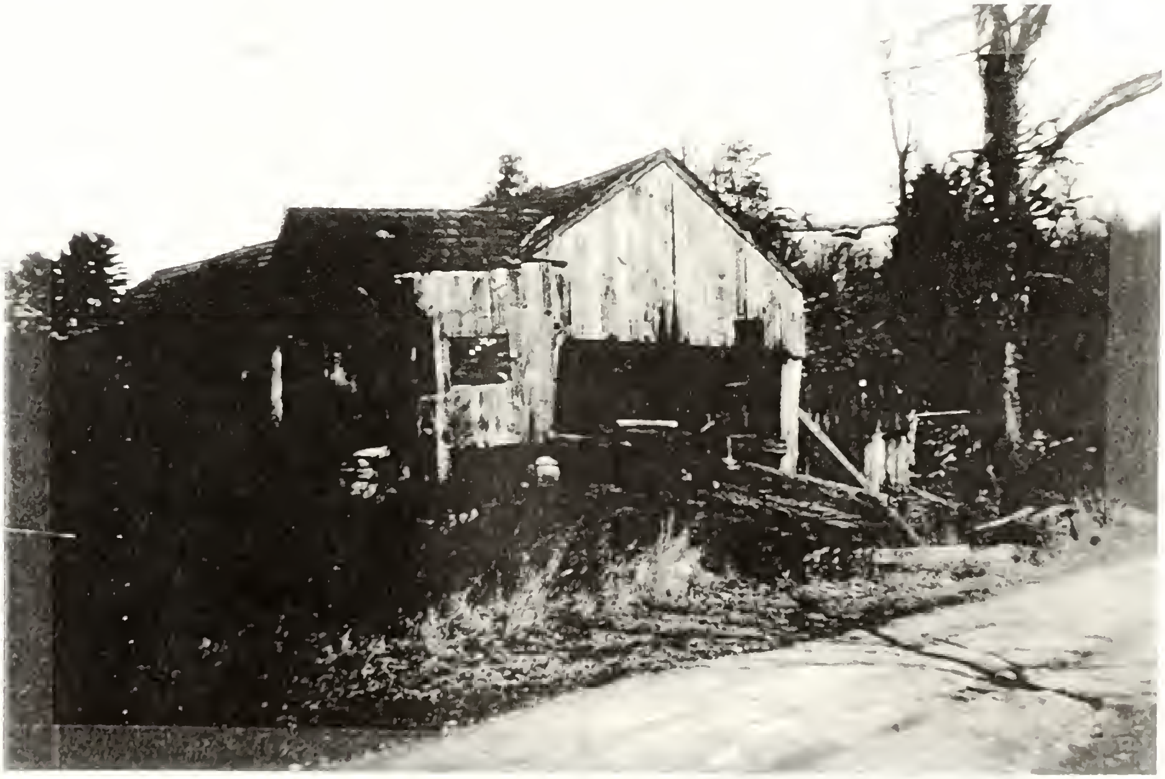


Fig. 17. Looking Up Mill Street Before 1920. (Sherborn Historical Society)

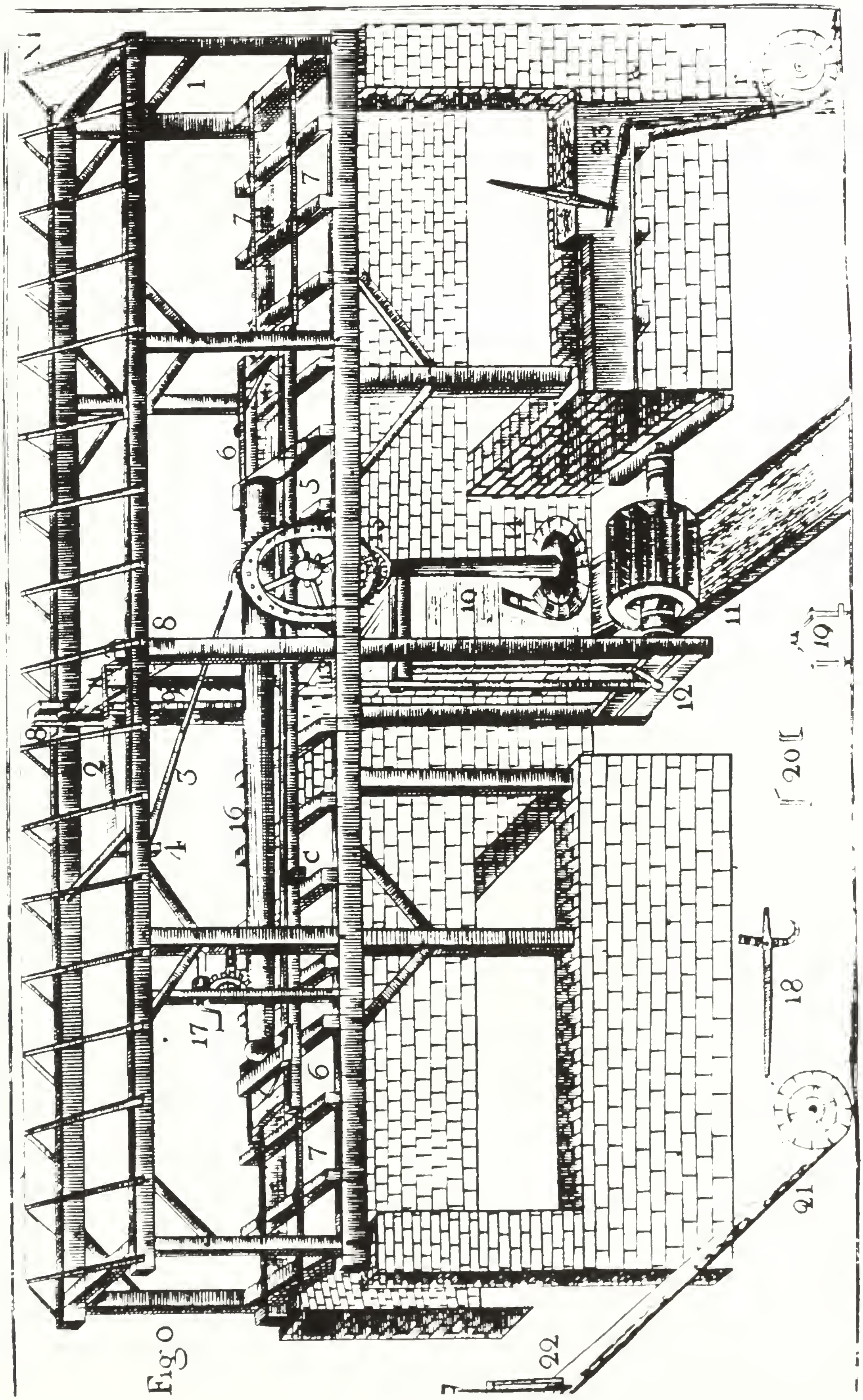


Fig. 18. Oliver Evans' Plan for an Up and Down Sawmill

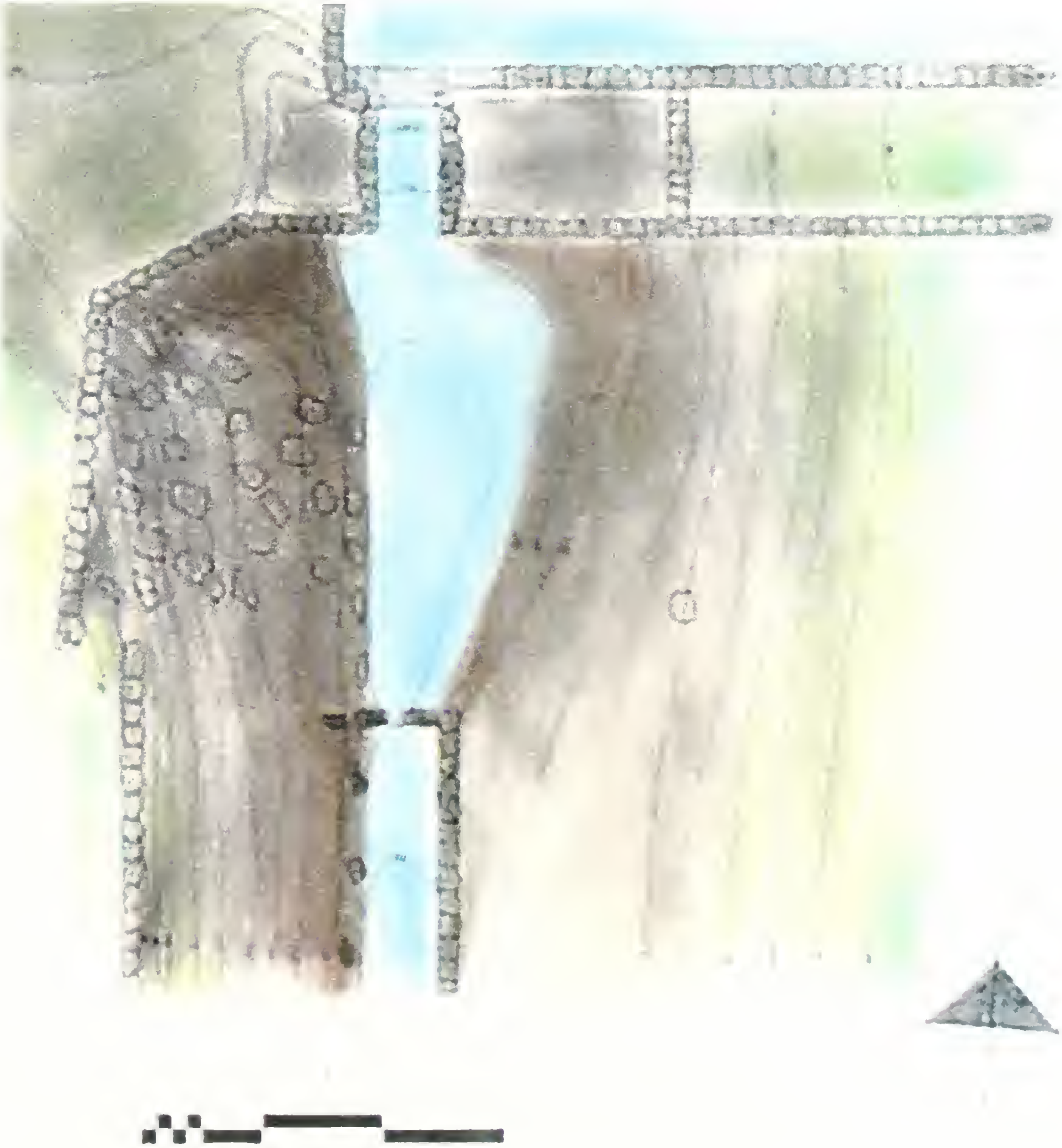


Fig. 19. The Lower Dam and Mill Topography

II: Master Plan

A detailed analysis of the existing conditions of the site was undertaken prior to creating a Master Plan. The site elements that were mapped included topography, soils and gradients, and vegetation. *See Figures. 20-24.* Glaciers molded the land of the Reservation. The steep grade on the western side of the property is a glacial esker – an accumulation of sand and gravel which was left in a ridge when the glacier receded. The natural watershed that featured a stream was altered by the construction of the dams that created the mill ponds which are prominent features of the landscape today. The land is wooded - almost in entirety. Species of woody and herbaceous vegetation vary with the topography. Interpretation of the elements that were analyzed guided the development of a map of the design constraints and potentials of the property. *See Figure 25.* The major constraints of the Reservation are:

- the state of disrepair of the dams and mill foundations
- the inaccessibility for the public due to lack of on-site parking, overgrown vegetation and lack of trail maintenance
- the lack of definition of property bounds
- the lack of funds for adequate administration and maintenance.

The major potentials of the Reservation fall into two categories:

- Educational –
    - Historic- a site to observe and study early New England industrial heritage
    - Environmental– a unique woodland/wetland/pond ecosystem to observe and study
- Passive recreation
    - Interesting trails for easy hikes, cross country skiing, horseback riding
    - Fishing
    - Quiet reflection spots

A diagram was made which shows the relationships between the various parts of the property and the flow of people between those areas for the proposed design. Finally, a synthesis of all of the elements to be considered in the Master Plan for the property was compiled. *See Figure 26.*

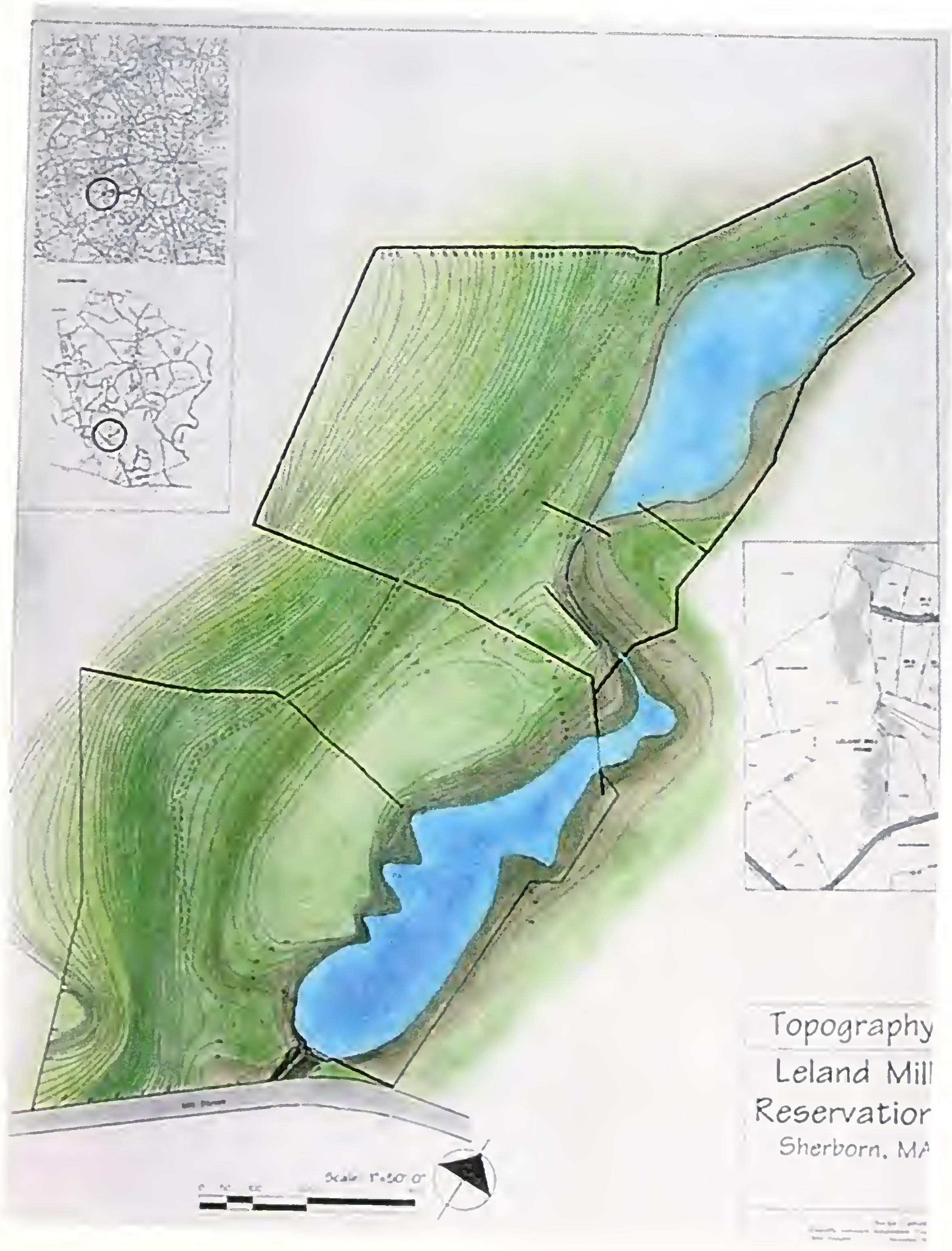


Fig. 20. Site Analysis - Topography

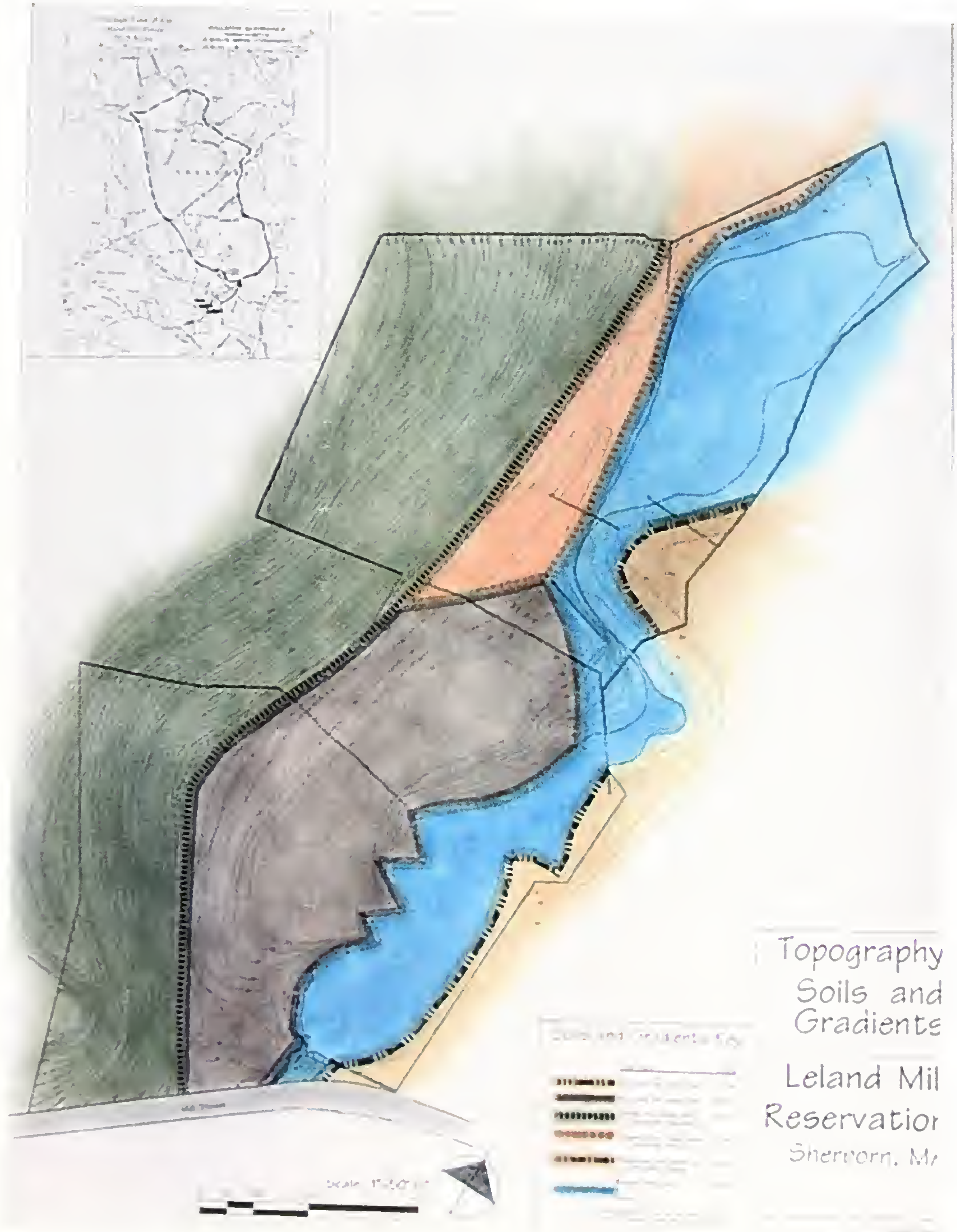
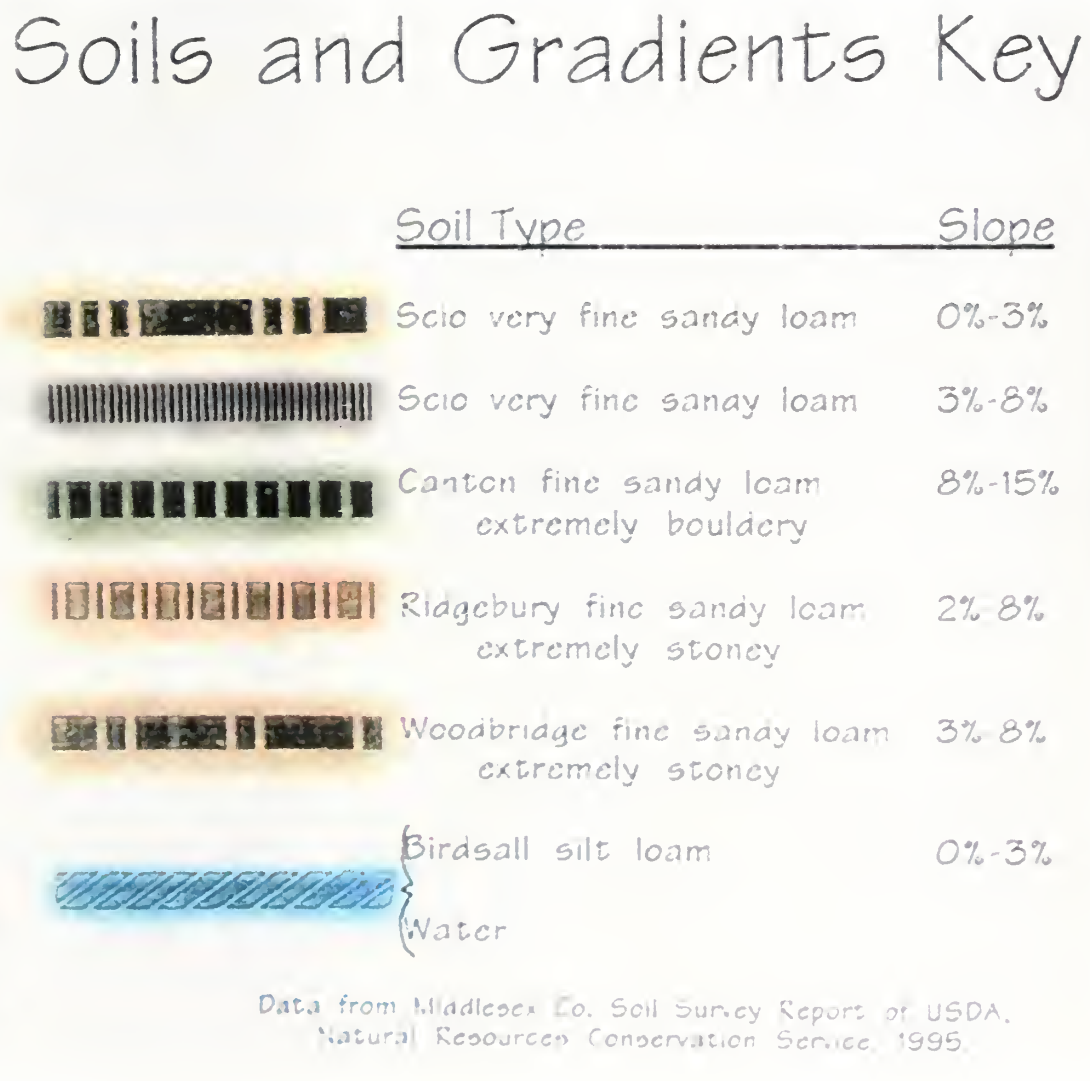


Fig. 21. Site Analysis - Soils and Gradients



Soils and Gradients Key

	Soil Type	Slope
▥	Scio very fine sandy loam	0%-3%
▥	Scio very fine sandy loam	3%-8%
▥	Canton fine sandy loam extremely bouldery	8%-15%
▥	Ridgebury fine sandy loam extremely stoney	2%-8%
▥	Woodbridge fine sandy loam extremely stoney	3%-8%
▨	Birdsall silt loam	0%-3%
	Water	

Data from Middlesex Co. Soil Survey Report of USDA, Natural Resources Conservation Service, 1995.

Fig. 22. Soils and Gradients Key, (enlarged)

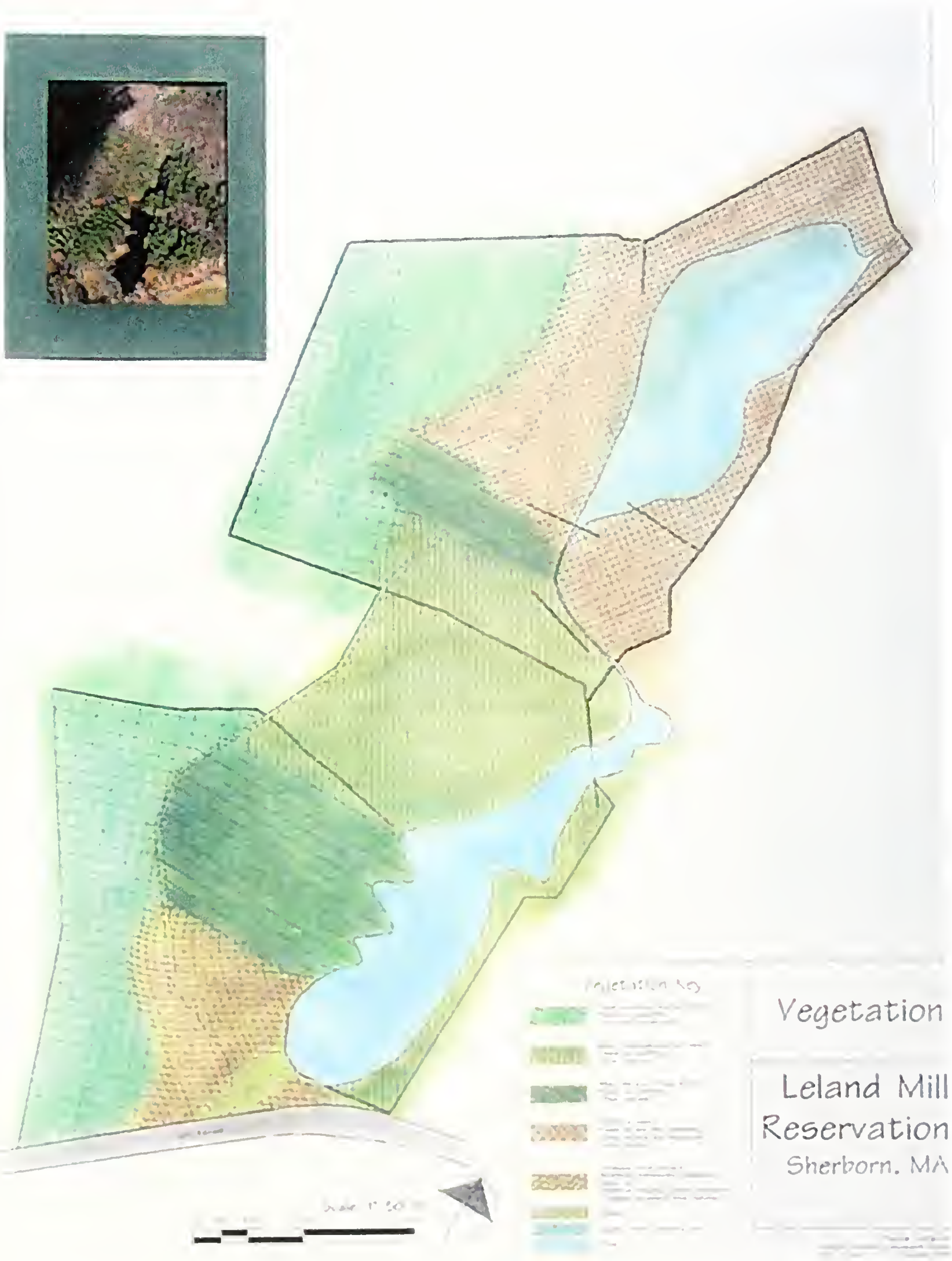


Fig. 23. Site Analysis - Vegetation

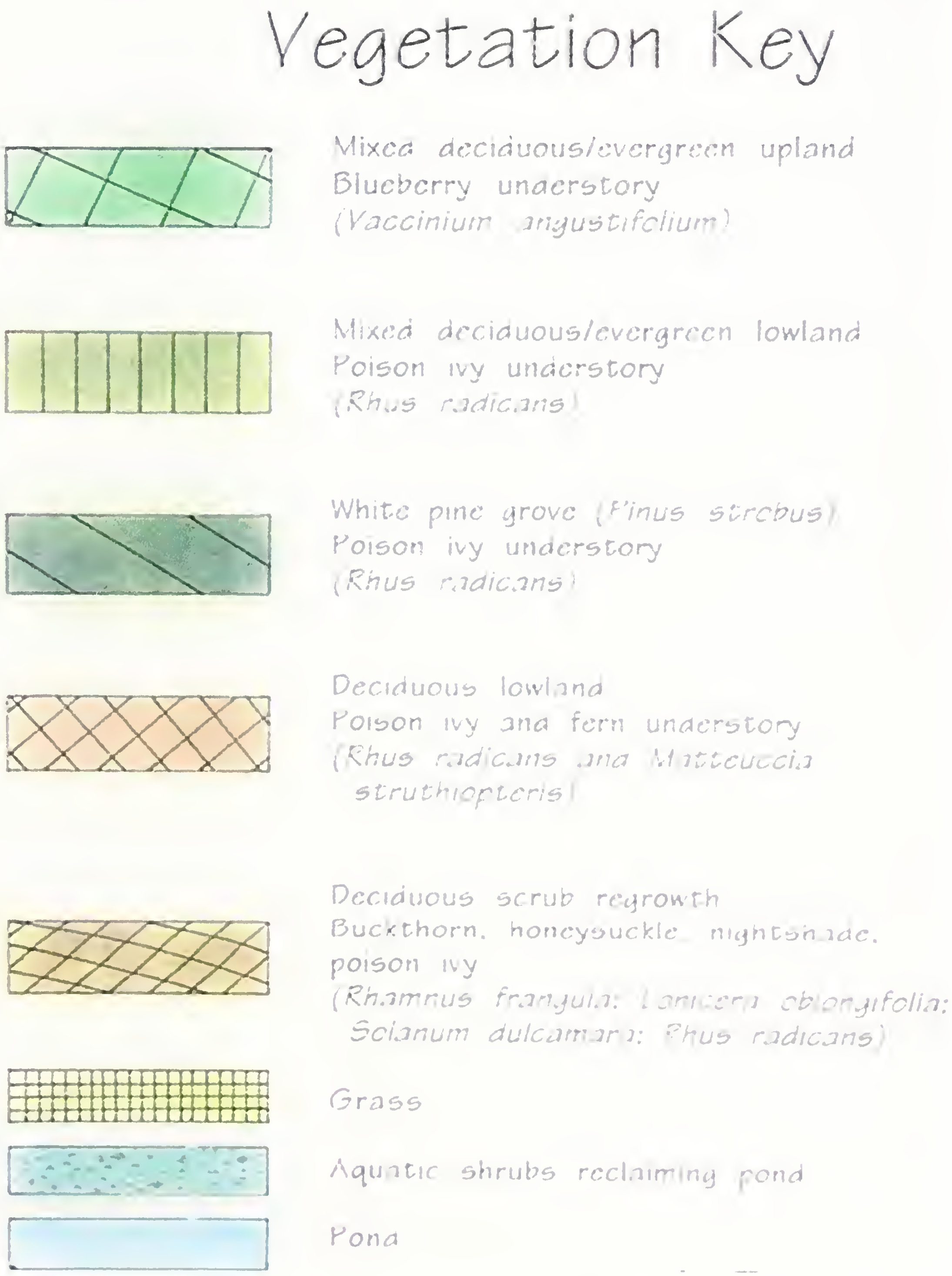

Vegetation Key
Mixed deciduous/evergreen upland
Blueberry understory
(Vaccinium angustifolium)
Mixed deciduous/evergreen lowland
Poison ivy understory
(Rhus radicans)
White pine grove (Pinus strobus)
Poison ivy understory
(Rhus radicans)
Deciduous lowland
Poison ivy and fern understory
(Rhus radicans and Matteuccia struthiopteris)
Deciduous scrub regrowth
Buckthorn, honeysuckle, nightshade, poison ivy
(Rhamnus frangula; Lonicera oblongifolia; Solanum dulcamara; Rhus radicans)
Grass
Aquatic shrubs reclaiming pond
Pond

Fig. 24. Vegetation Key, (enlarged)

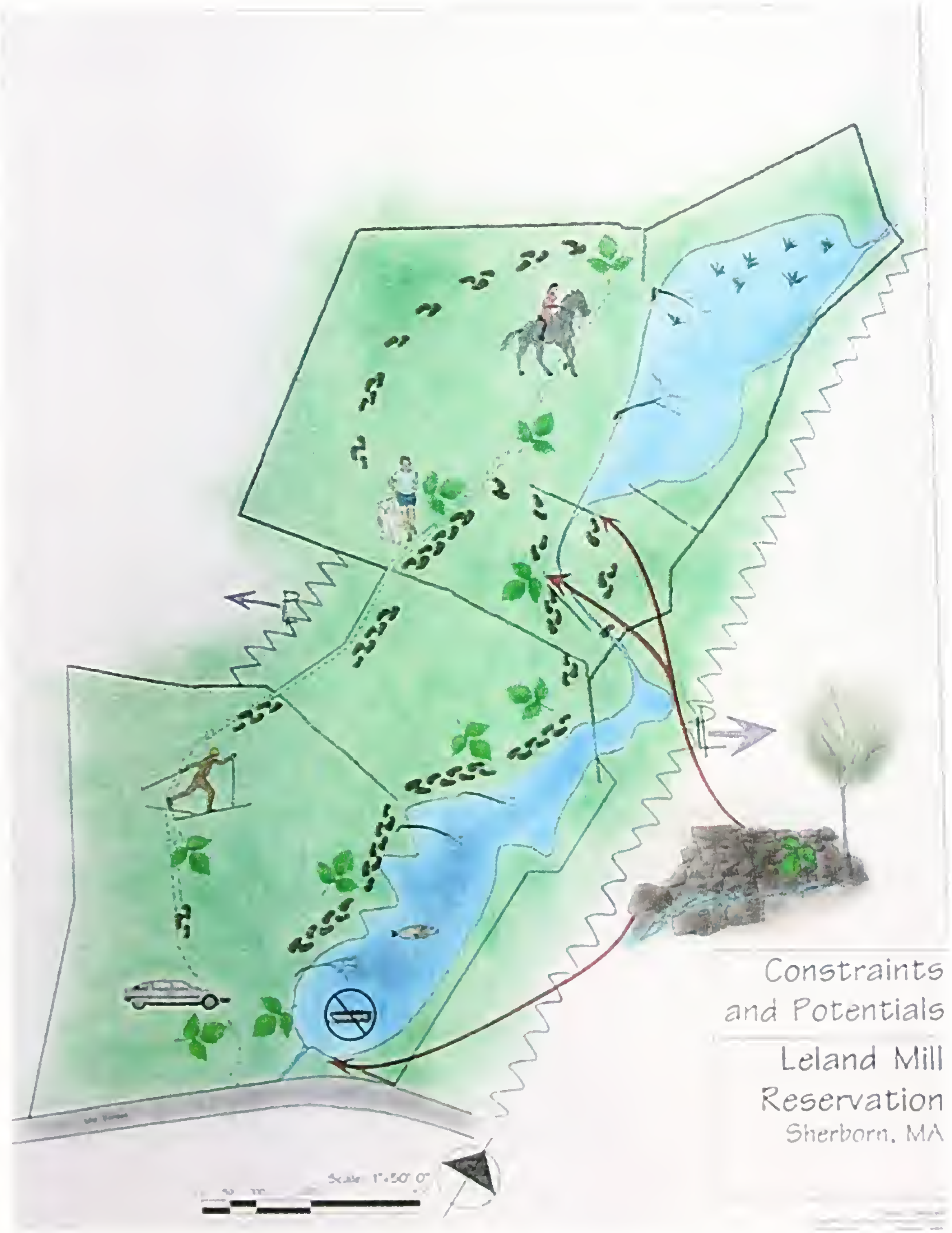


Fig. 25. Site Analysis - Constraints and Potentials

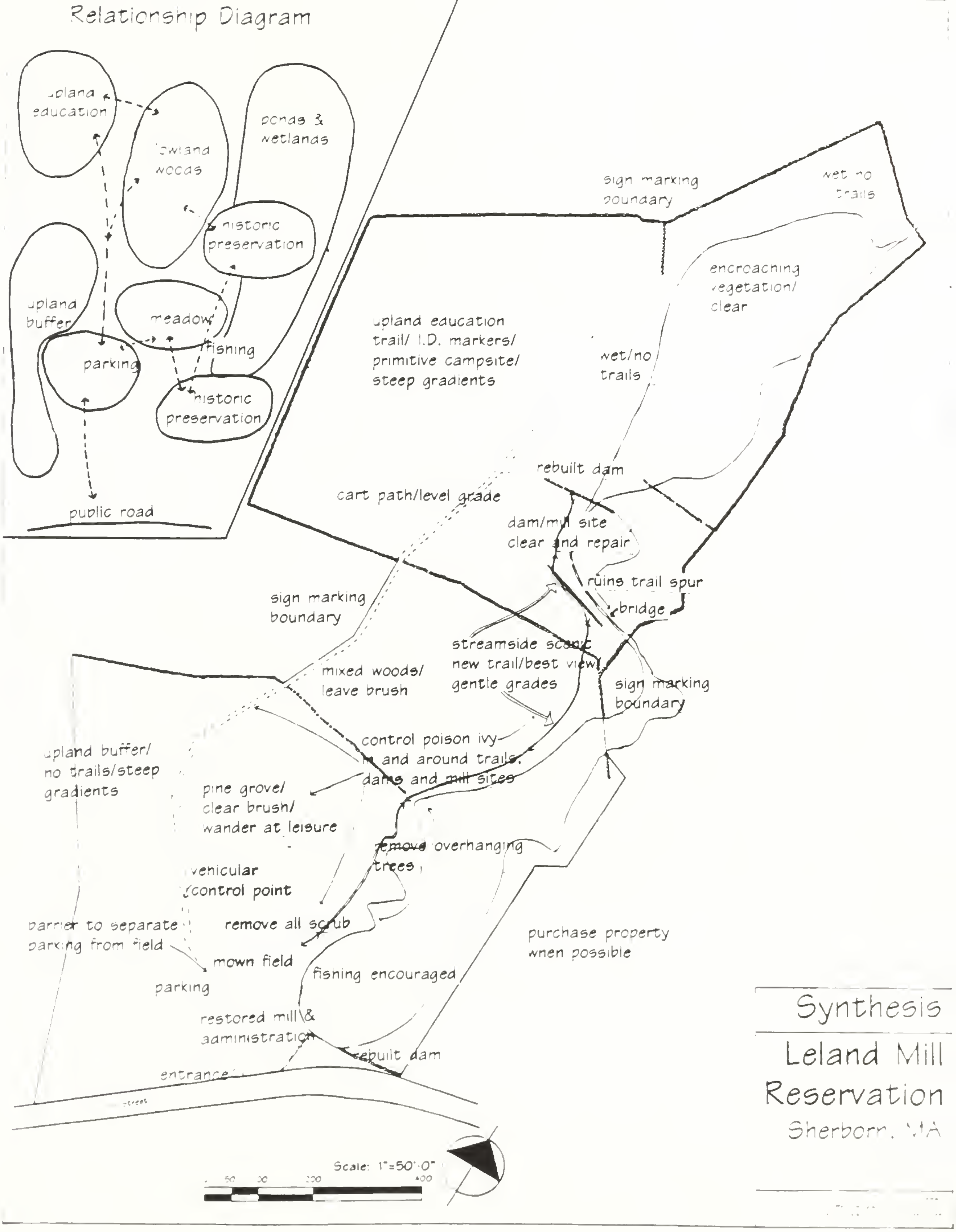


Fig. 26. Site Analysis - Synthesis

The Master Plan for the Leland Mill Reservation evolved from the study of the history and the analysis of the site. *See Figure 27.* The major components of the Master Plan are:

1. The development of an ecologically balanced system of native species of vegetation that will be accessible to the public by improving and/or creating of new trails and establishing defined off-street parking.

2. Design of clear definitions of the property bounds.

3. Reconstruction of the lower dam.

4. The development of an appropriate administration and maintenance plan.

One of the most important considerations in developing a landscape design which preserves the Cultural Landscape of the Leland Mill Reservation is the creation of an ecologically balanced system which will encourage native species of both flora and fauna in this "natural appearing" pond/wetland/woodland setting which is acknowledged to be "manmade". The vegetation map, (*See Figures 23-24)*, graphically indicates that currently there are several different, distinct areas of vegetation. The section which follows suggests appropriate treatments for the various vegetation areas indicated. The six vegetation areas differentiated in the key are grouped based on similarity of vegetation within an area and proximity to the water table, and then addressed as three ecological zones in this section. The three resulting zones are each treated separately in the Master Plan:

1. Mixed deciduous upland
2. Grass and scrub
3. Lowland woods

Each of these three zones is analyzed in detail as to the existing conditions, then followed by recommended modifications per the Master Plan.

The first ecological zone to be analyzed is the upland portion of the Reservation. The mixed deciduous upland portion of the Reservation is in two sections of the property. As indicated on the synthesis map, (*See Figure 26),* the southwestern portion will be untouched, to remain a buffer zone. The northwest upland portion of the property, bordered by stone walls dating from the time the land was pasture, has been reclaimed primarily by native vegetation. At the lower edge of this section are the remains of some shallow "borrow pits", excavated for fill when the upper dam was being built are

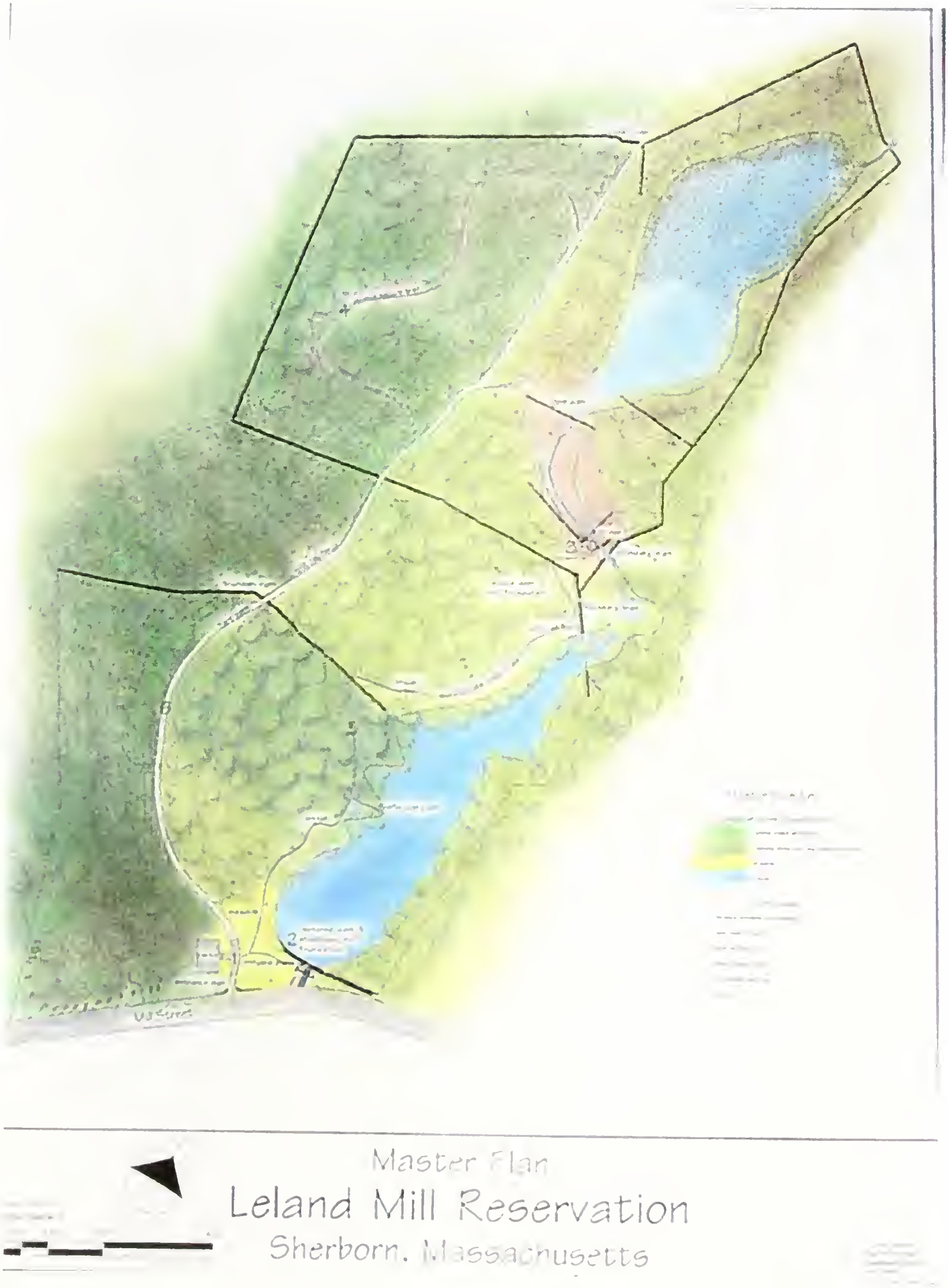


Fig. 27. Master Plan

found.[8] The canopy of this portion is a mixed deciduous and evergreen forest which has evolved west of the cart path. This canopy is primarily, but not exclusively, composed of:

Quercus alba (white oak)
Quercus rubra (red oak)
Quercus velutina (black oak)
Pinus strobus (white pine)

The understory woody species in this upland portion of the property is primarily Vaccinium angustifolium (lowbush blueberry). Additionally there is a variety of herbaceous species in this upland woods.

Modifications that I suggest for this northwest upland will establish an upland educational area focusing on native wildflowers. I recommend that the northwest upland area continue in general to mature as it is doing now. I suggest additionally that the native woodland species be "encouraged" and that exotic invasives and poison ivy be selectively removed as they encroach from the adjoining lowland. The northwest section of the upland woodland will become a study area of native New England woodland wildflowers and trees. A loop path will be laid out in this section, as indicated on the Master Plan Map, *See Figure 27*, so that the flora can be studied yet protected. As a species appears naturally, it should be labeled and protected. Below is a list of native woodland wildflowers that might have originally been in a location such as this before the land was used for pastureland.

Some of the species listed below may be on the site now:

Chimaphila maculata (Spotted wintergreen)
Claytonia virginica (Spring beauty)
Clintonia borealis (Corn lily)
Cypripedium various species (Lady's slipper)
Goodyera pubescens (Downy rattlesnake-plantain) *See Figure 28.*
Lycopodium clavatum (Stag's-horn Clubmoss)
Mitchella repens (Partridgeberry) *See Figure 29.*
Monotropa uniflora (Indian pipe) *See Figure 30.*
Panax trifolius (Dwarf ginseng)
Sanguinaria canadensis (Bloodroot) *See Figure 31.*
Smilancina various species (False Solomon's-seal)
Trientalis borealis (Starflower)
Trillium various species *See Figure 32.*
Uvularia various species (Bellwort) *See Figure 33.*

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[8] Lance, 80.

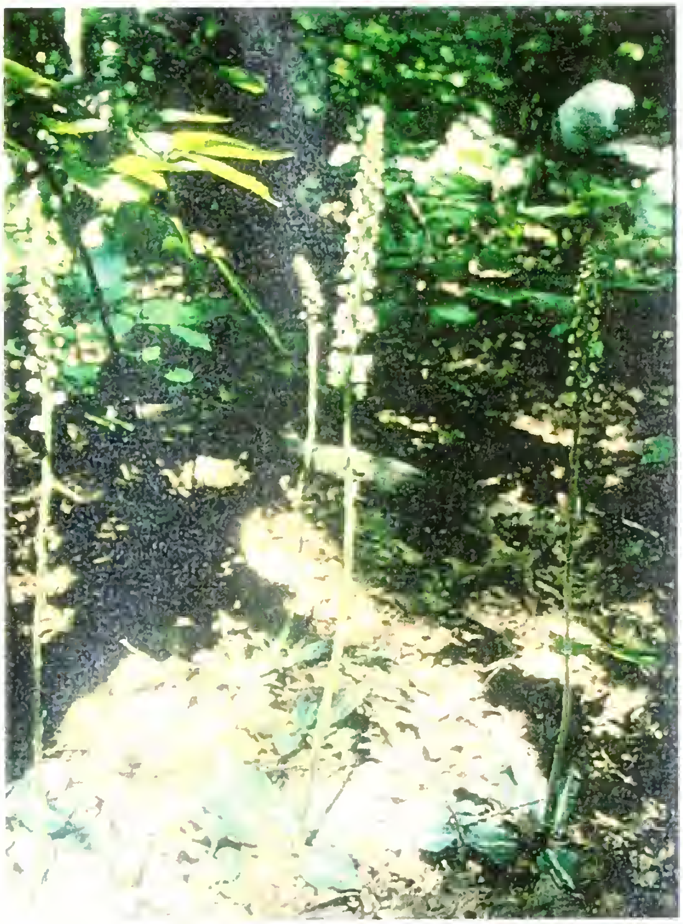

Fig. 28. Downy Rattlesnake Plantain (New England Wildflower Society)

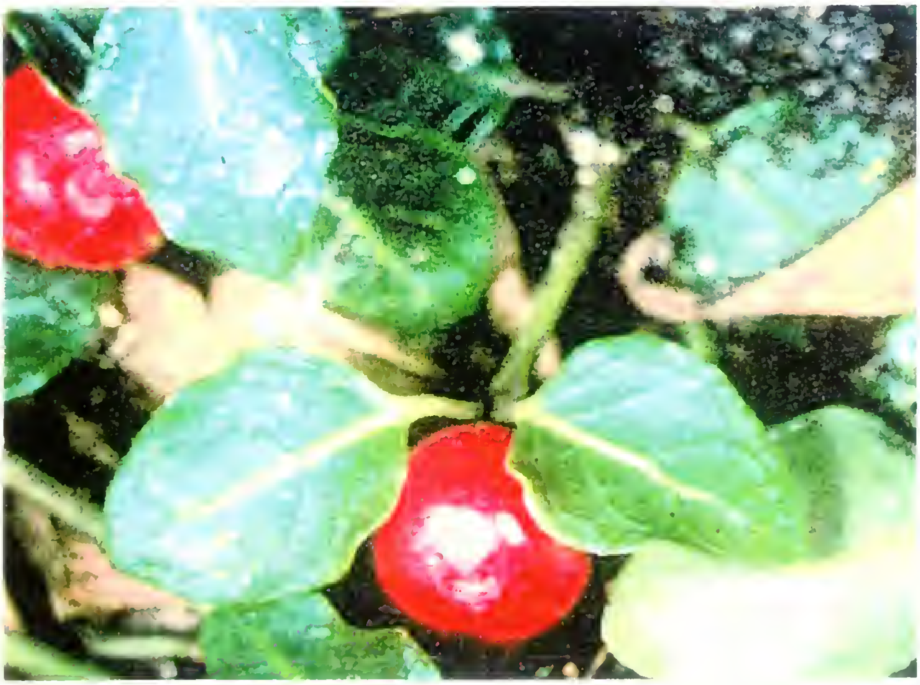

Fig. 29. Partridgeberry (New England Wildflower Society)

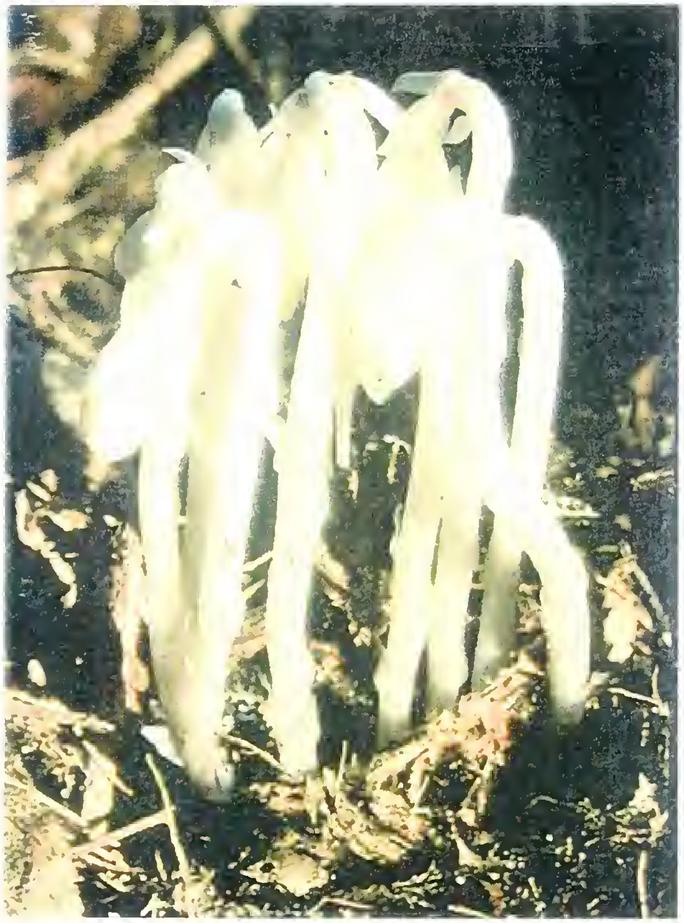

Fig. 30. Indian Pipes (New England Wildflower Society)

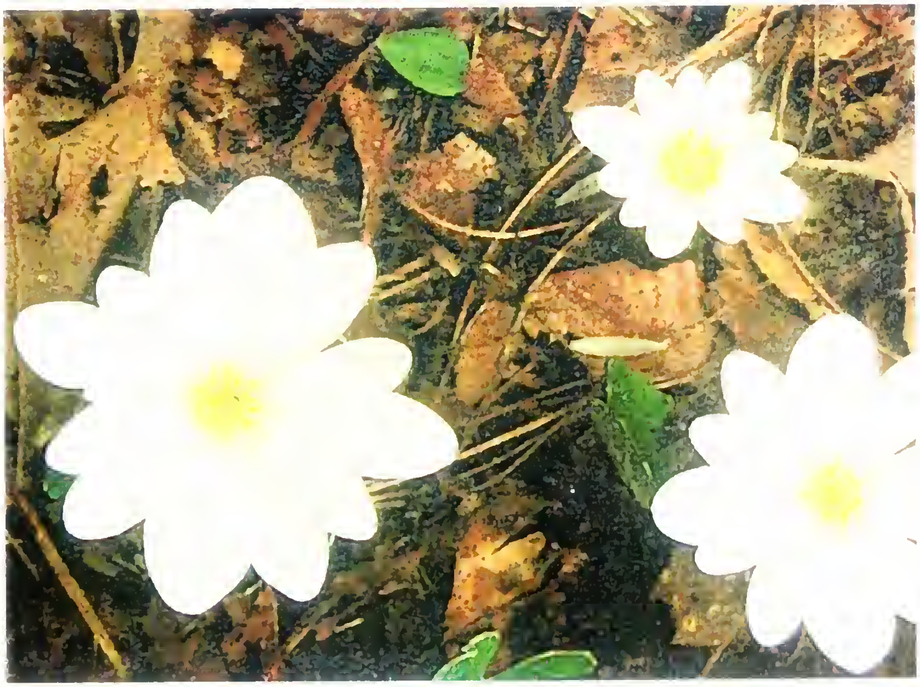

Fig. 31. Bloodroot (New England Wildflower Society)

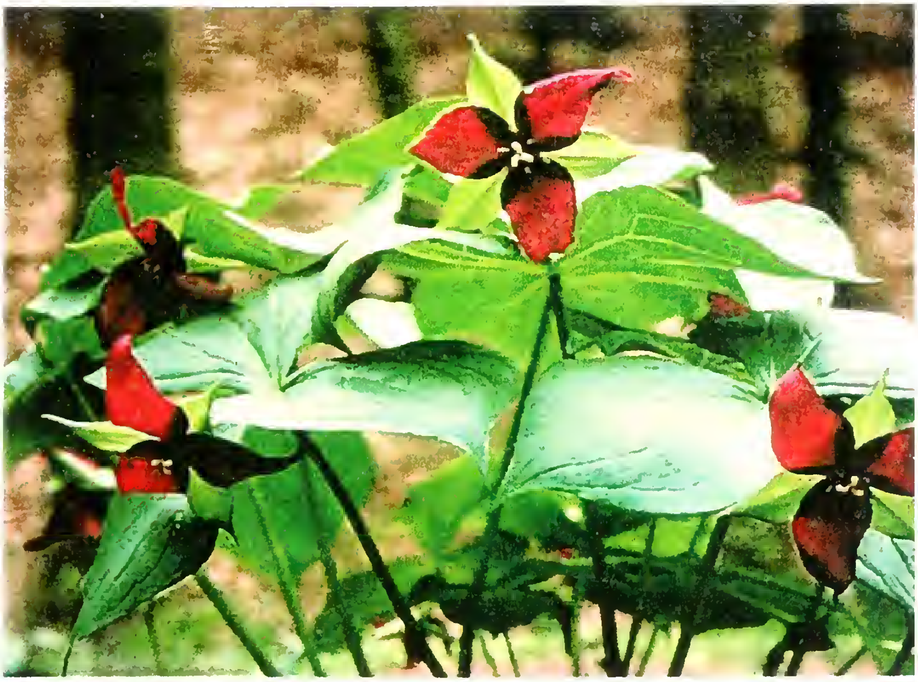

Fig. 32. Trillium (New England Wildflower Society)

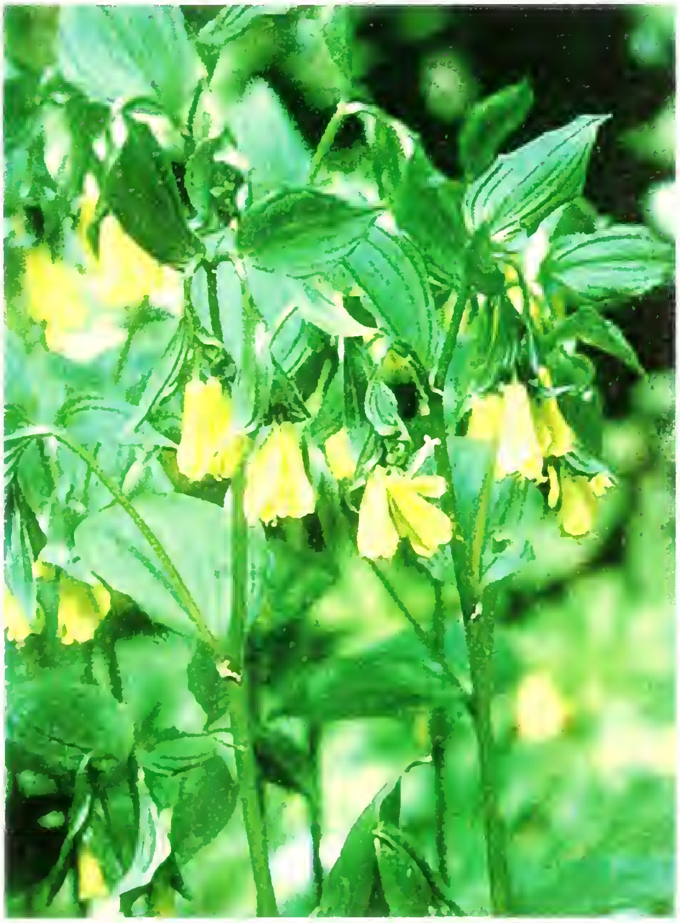

Fig. 33. Bellwort (New England Wildflower Society)

This upland education area will become a long-term science/horticultural project for the schools and others in the wider community, possibly in conjunction with a local garden club, and administered by the Conservation Commission.

The second ecological zone of vegetation of the Reservation to be analyzed is the scrub/grass portion of the Reservation, west of the lower dam, near the street. This relatively flat area, which abuts Mill St., west of the lower pond, is the most recently and recurrently disturbed portion of the property. The entrance to the reservation is located here. *See Figure 34.* This area was probably cleared for the lumber yard - the main open work area beside the mill. The Fire Department installed one of their dry hydrants here within the last ten years. A pipe running from the pond to a hydrant by Mill Street was buried near the mill ruins. *See Figure 35.* Twenty years ago there was a parking area for fishermen and skaters off to the west of the cart path. The cart path, which is now a popular horseback riding trail transverses this part of the reservation. Regular deposits of horse manure drop seeds and fertilizer onto the land. This portion of the reservation is now an example of scrubby first growth trees, shrubs and perennials. The few trees which are in this area are Acer rubrum (red maples), averaging 12"-15" in diameter - indicating that they have grown in the last thirty years.

Understory woody growth in this area is primarily pioneer invasives, both native and exotic:

- Lonicera oblongifolia (Swamp Fly-Honeysuckle)- native
- Rhamnus frangula (European Buckthorn) - exotic *See Figure 36.*
- Solanum dulcamara (Nightshade) - exotic *See Figure 37.*
- Rhus radicans (Poison ivy) - native

Perennial coarse grasses and herbaceous wildflowers compete with the poison ivy as a groundcover. The perennial rye was probably seeded after the dry hydrant pipe was installed by the Fire Department. Herbaceous plants in this area include, but are not limited to:

- Carex nigra (common sedge)
- Festuca pratensis (meadow fescue)
- Lolium perenne (perennial rye-grass)
- Solidago various species (goldenrod)
- Aster various species (aster)

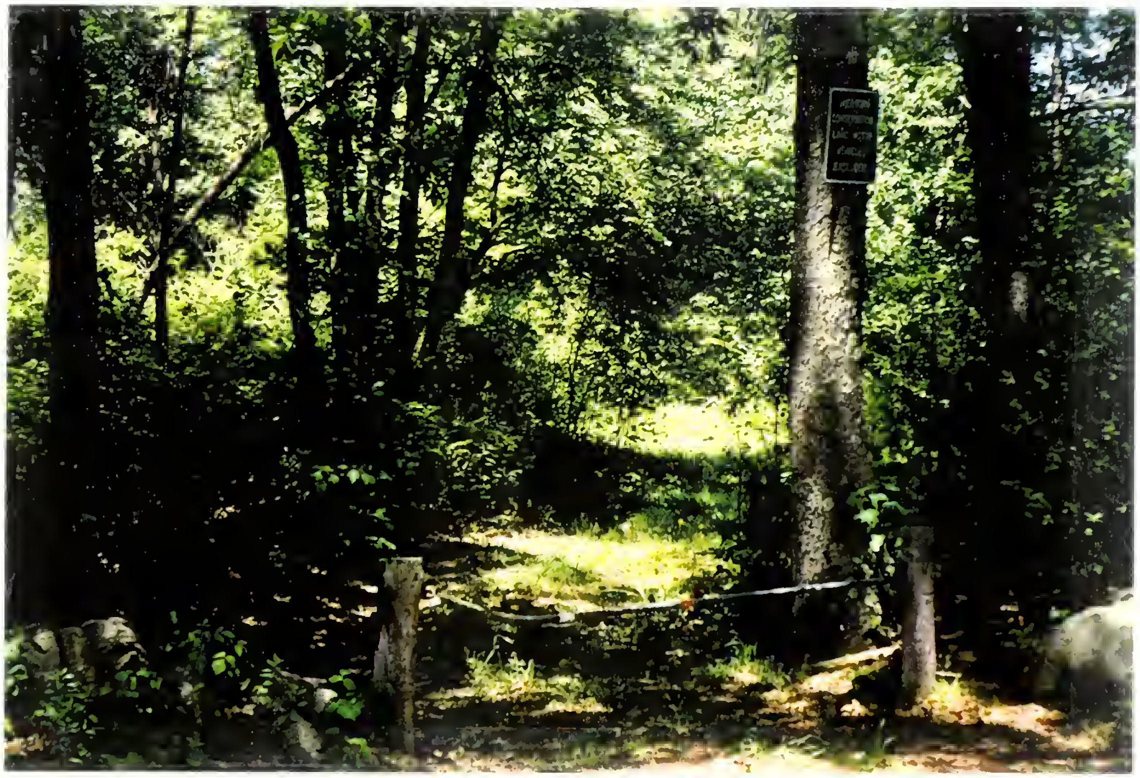

Fig. 34. Reservation Entrance Today

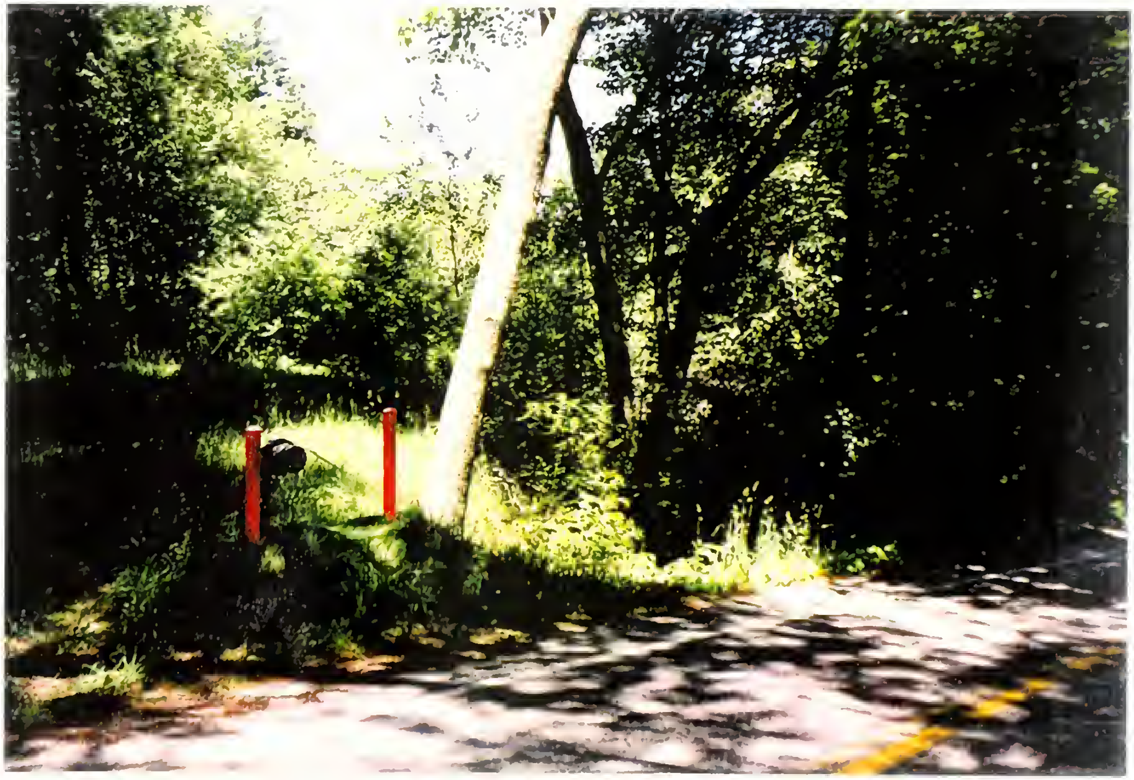

Fig. 35. Dry Hydrant Installed by the Fire Department

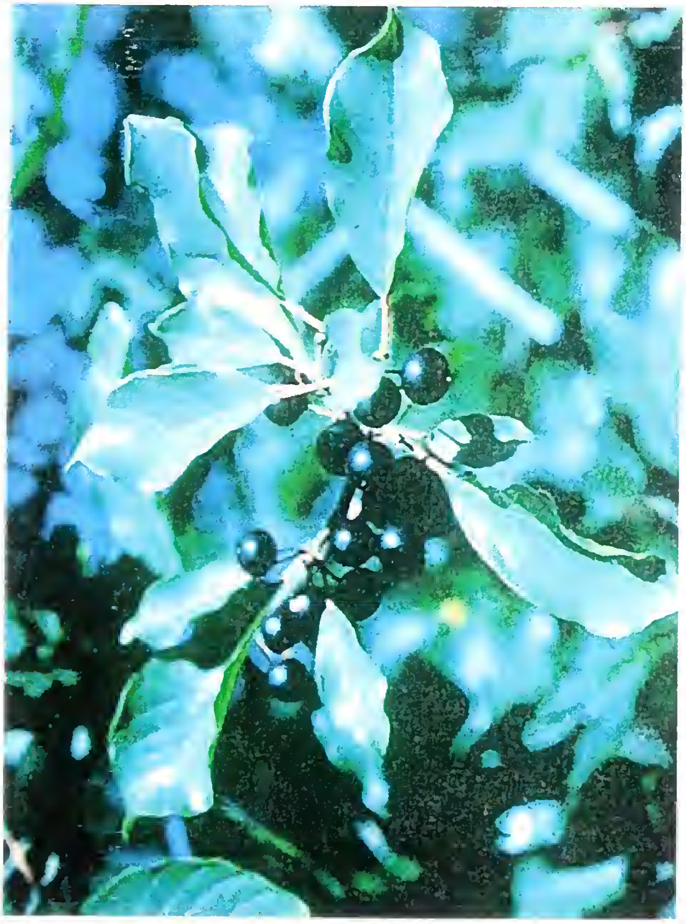

Fig. 36. Buckthorn (New England Wildflower Society)

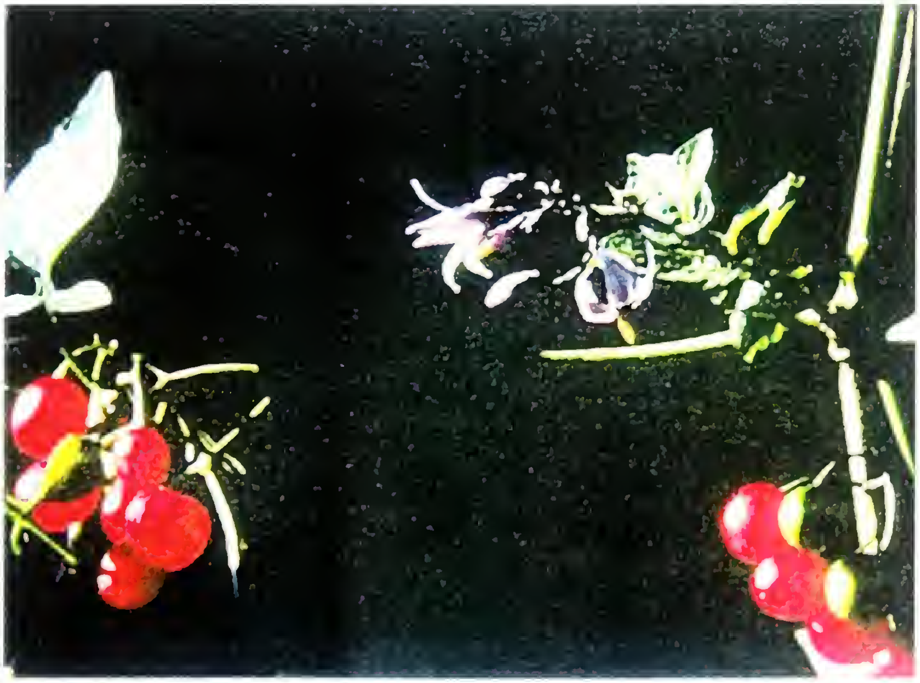

Fig. 37. Deadly Nightshade (New England Wildflower Society)

This ecologically disturbed area is the most heavily used part of the reservation. Any change has been carefully planned in order to accommodate visitors yet restrict their access to appropriate places. *See Figure 38.* Concurrently some of the existing vegetation needs to be altered to establish an open, accessible, relatively self-sustaining ecosystem. *See Figure 39.*Extensive study has been undertaken to explore what, if any, feasible solutions there are to the problems created by the existence of extensive infestations of the woody invasives listed above which are located in this area and are spreading into other portions of the Reservation. I began my inquiry in the scientific /academic community, in order to obtain a general, unbiased understanding of herbicides - their development, regulation and uses.[9] In this initial inquiry I learned that there are glyphosate-based products which can be used in aquatic applications without harm to the nearby water or wildlife. To determine if there were commercially available products I next examined information on herbicides produced by Monsanto Corp.

Glyphosate is within a class of herbicides that are approved by the Federal Government for aquatic application. One of these is glyphosate. A detailed analysis of glyphosate was a part of an Environmental Impact Statement and Responsiveness Study conducted by the Washington State Department of Ecology as a part of the Aquatic Plants Management Program for Washington State. The summary report explains that glyphosate (N-(phosphonomethyl) glycine) is a broad spectrum herbicide employed for the control of emerged aquatic vegetation. It must be applied when the plants are actively growing. It is rapidly absorbed and translocated throughout the plant. Any glyphosate that lands on water or soil during application onto vegetation is adsorbed onto sediment /soil and

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[9] Dr.James E. Martin, Chemistry Dept., NCSU. *personal e-mail,* 8.98.

Washington State Department of Ecology, *Aquatic Plants Management Program for Washington State, Final Supplemental Environmental Impact Statement and Responsiveness Summary, Vol 1.* (January, 1992), 119-131.

Jim Kells, *Poison Ivy Control Douglas O. Lantagne Department of Forestry*, Michigan State University Extension Bulletins, 01/01/94, 1-4.

Norton H. Nickerson, "Impacts of Vegetation Management Techniques on Wetlands in Utility Rights-of-way in Massachusetts"*Journal of Arborculture* 18:(2) March, 1992, 102-107.(Nickerson is a Professor of Environmental Studies at Tufts. He was one of the main authors of the Commonwealth's Wetlands Protection Act.) This is a detailed analysis of the impact of herbicide use compared with mechanical vegetation management at several field sites in Massachusetts. He assesses the risks of herbicide use and predicts herbicide residue fate. The author's conclusion is that mechanical techniques have a greater negative environmental impact on aquatic vegetation than any lasting impact from target basal, cut stump or foliar applications of herbicides.

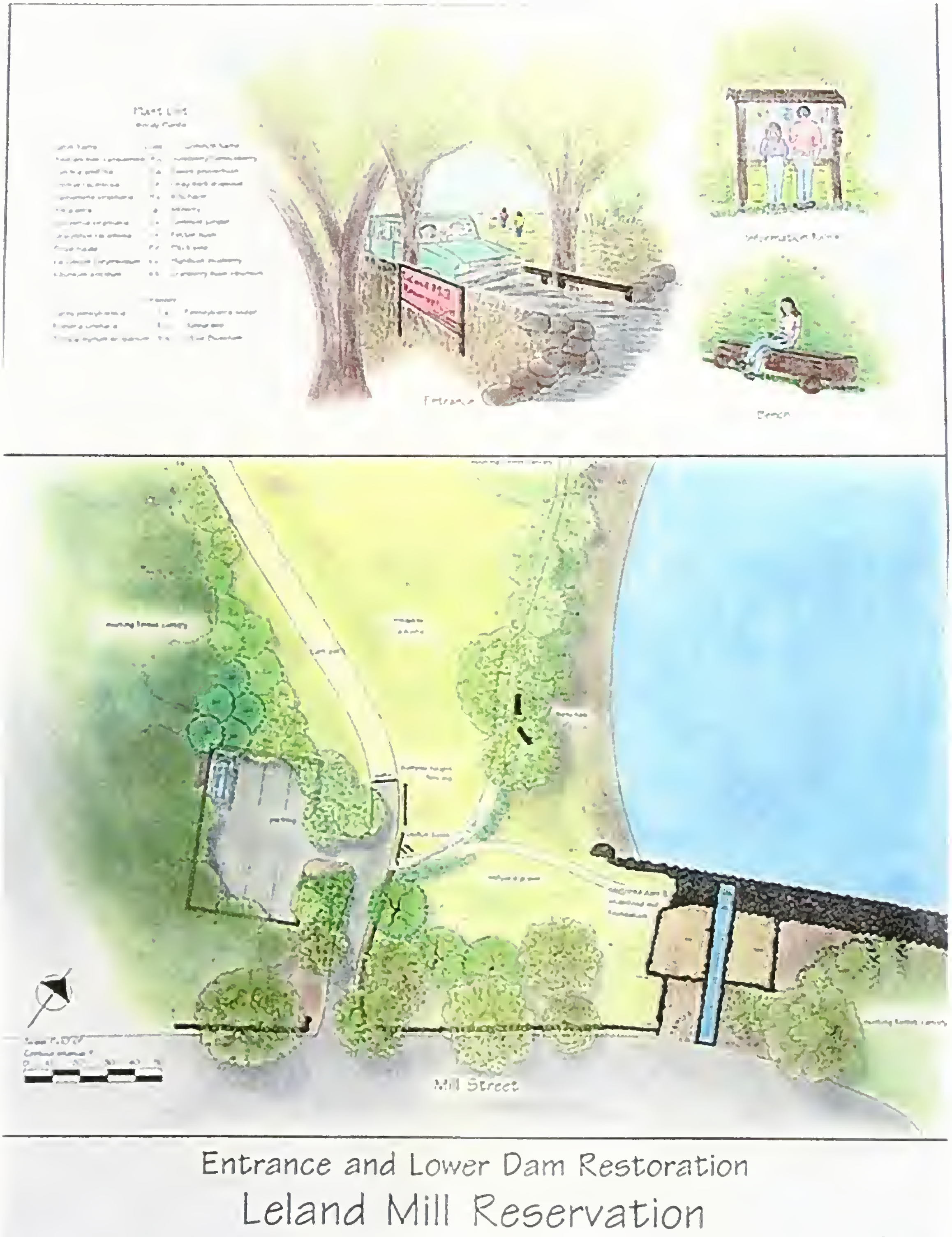

Fig. 38. Entrance and Lower Dam Restoration

Woody Plants

Latin Name	Code	Common Name
Amelanchier canadensis	A.c.	Juneberry/Serviceberry
Clethra alnifolia	C.a.	Sweet pepperbush
Cornus racemosa	C.r.	Gray bark dogwood
Hamamelis virginiana	H.v.	Witchazel
Ilex glabra	I.g.	Inkberry
Juniperus virginiana	J.v.	Common juniper
Leucothoe racemosa	L.r.	Fetter-bush
Pinus rigida	P.r.	Pitch pine
Vaccinium corymbosum	V.c.	Highbush blueberry
Viburnum trilobum	V.t.	Cranberry bush viburnum
	Grasses	
Carex pensylvanicia	C.p.	Pennsylvania sedge
Koeleria cristata	K.c.	Junegrass
Schizachyrium scoparium	S.s.	Little Bluestem

Fig. 39 Planting Plan

inactivated. It is the strong adsorption of glyphosate to sediment/soil that reduces its mobility through leaching and surface runoff. The adsorption to sediment/soil is additionally responsible for the product being non-toxic to wildlife. In aquatic use, glyphosate has a minimum half-life of two weeks with an average soil half-life of sixty days. It is degraded primarily by microorganisms. Adverse impacts to surface water quality only occur if large amounts of vegetation are treated in the water. Such treatment is not being suggested for Leland Reservation wetlands.

The Federal Government requires that chemical companies produce, and make public Technical Fact Sheets (TFS) and Material Safety Data Sheets (MSDS) on their products. My assessment of the corporate materials analyzing and explaining glyphosate is that they agree with the analysis in the academic community. Careful study of TFS and MSDS for six Monsanto products (Weed-B-Gon Lawn Weed Killer 2^{TM}, Brush-B-Gon Poison Ivy^{TM}, Poison Oak & Brush Killer 1^{TM}, Roundup Concentrate Brush Killer^{TM}, Rodeo Emerged Aquatic Weed and Brush Herbicide^{TM}, and Accord^{TM}) were studied. The study concludes that controlled application of Rodeo^{TM} and Accord^{TM}, both glyphosates, with the addition of a non-ionic surfactant as directed, would be an environmentally sound approach to rid the scrub area of the Reservation of invasives. This will be the first step in rehabilitation of this ecosystem. Glyphosate has been classed by the Environmental Protection Agency in Category "E" - evidence of non-carcinogenicity for humans, as well as being given the aquatic approval indicated previously. Category "E" is the most favorable Federal Government rating that exists. Complete data sheets on glyphosate, Rodeo^{TM} and Accord^{TM} may be found in Appendix C.

My study of aquatic herbicides through academic, governmental and commercial sources, as outlined above, concludes that a glyphosate based aquatic approved herbicide is the appropriate chemical to be applied at Leland Mill Reservation. Application is recommended only in the areas so indicated on the Map. *See Figure 40.* I have selected these areas to be treated because visitors heavily use them, because the growing roots of vegetation in the historic ruins will further destabilize them and because the exotic and native invasive vegetation is worst in these areas. In order for glyphosate to be applied on a given site in the buffer zone of a wetland, the following process should be followed:

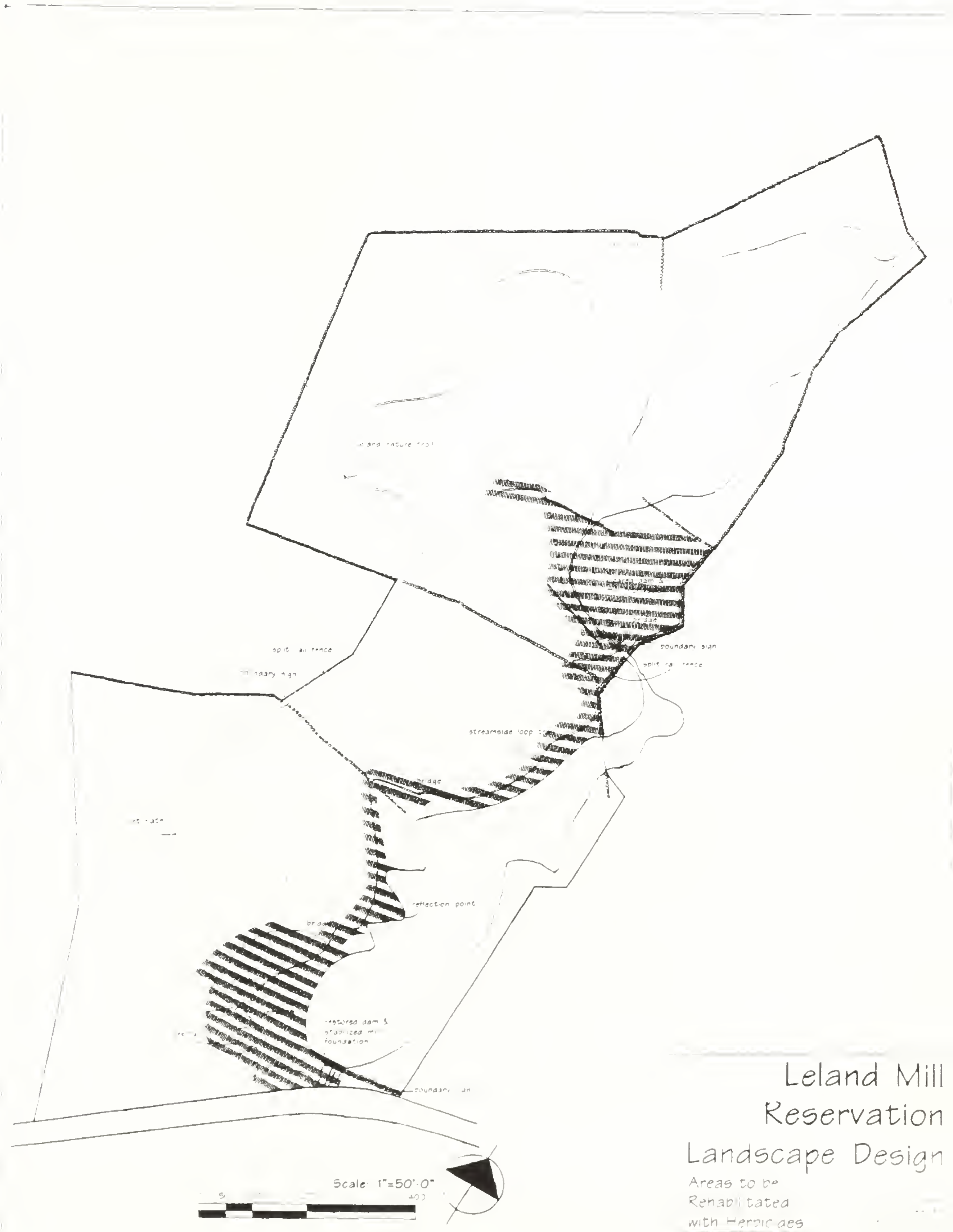

Fig. 40. Herbicide Application Map

1. Request the local Conservation Commission to make a determination on the application to treat an area.
2. An Order of Conditions will be issued. This Order will indicate parameters within which the herbicide could be applied, as well as post-application inspection procedure.[10] (Implementation of a comprehensive planting plan may be a part of an Order of Conditions.
3. Following final inspection, the Conservation Commission will sign off on the Order of Conditions.

Glyphosates are non-selective herbicides, meaning that they kill all vegetation that they touch. They do not, however, harm ungerminated seeds that are on the ground at the time of herbicide application. Reports of extensive wildlife habitat restoration projects that I have read indicate that the dead/dying root structure of sprayed vegetation will hold the soil until other selected seeds germinate, preventing erosion. There are several methods of application that would be appropriate on the Reservation:

1. Cut-stem application. Woody shrubs, such as buckthorn, can be cut down and the stumps "painted" with Roundup or Accord. This is a 100% selective method of eradication.

2. Hand-held or knapsack sprayers may be used in heavily infested areas of poison ivy. This should be done only under specified weather conditions and under the supervision of one of the Town's State Certified Category #36 & #37 Commercial Pesticide Applicators.[11]

3. "Hack and squirt" technique has been successfully employed in wildlife habitat restoration. For example, this would involve wounding a poison ivy vine climbing up a tree that is to be

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[10] Brad Mitchell, Bureau Chief of the State Food and Agriculture's Pesticide Bureau, phone interview 3/4/99. "Local implementation of allowable herbicide treatment falls under the State Pesticide Bureau. They produce a list of acceptable herbicides for application in rights-of-way, including wetlands." The complete state list of recommended herbicdes is found in Appendix D

[11] Town Tree Warden and one additional member of the Community Maintenance and Development Department.

preserved, and then squirting Roundup or Accord directly on the open wound. This would kill the poison ivy vine and not injure the supporting tree.

The design for this current scrub area is a meadow and millyard of relatively low growing native perennial grasses. *See Figure 38.* This area needs to be an open area in order to welcome visitors and provide easy access for fishing by the dam, hiking the loop trail, and observing the ruins. Species to be seeded here include:

Schizachyrium scoparium (Little bluestem)
Carex pensylvanica (Pennsylvania sedge)
Koeleria cristata (June grass)

Seed for the meadow and millyard will be sown concurrently with herbicide application. Annual mowing is recommended for the meadow; monthly mowing is recommended for the millyard grass.

Vehicular access has been addressed, as indicated on *Figure 38.* Utility pole fencing set a bumper height, centered on 22", on the east side of the entry drive, as well as surrounding the parking lot will restrict vehicles, thereby protecting the meadow area beside the lake. A gate will control vehicular access to the cart path beyond the parking lot. The gate will only be opened by the fire department or police. The organic soils in the indicated drive/parking area should be removed and replaced with compacted crusher run topped with 3/4" gravel. This will provide a stable yet porous surface for vehicles.

Berry-bearing understory trees and shrubs will be planted, as indicated on the Entrance Plan. *See Figures 38-39.* These native trees and shrubs will create a diverse plant community that will provide food for birds throughout the year - replacing the invasive buckthorn that has choked out native species. The existing forest canopy will be kept clear of any understory between the parking lot and Mill Street, however, in order to give police clear view for monitoring activitiy in the parking lot.

Species to be planted in this area include:

Amelanchier canadensis(juneberry; Service-berry)
Clethra alnifolia (Sweet Pepperbush) *See Figure 41.*
Cornus racemosa (Gray bark dogwood) *See Figure 42.*
Hamamelis virginiana (Witchazel)
Ilex glabra (inkberry)
Juniperus virginiana (Red cedar; Common juniper)

Leucothoe racemosa (Fetter-bush) *See Figure 43.*
Pinus rigida (Pitch pine)
Vaccinium corymbosum (Highbush blueberry) *See Figure 44.*
Viburnum trilobum (cranberry bush viburnum)

The third and final ecologic zone analyzed is the lowland woods which encompasses the upper historic/archaeological site, the entire perimeter of the upper pond and all but the scrub/grass section of the lower pond. The canopy includes:

Pinus strobus (white pine)
Quercus veluntina (Black oak)
Acer rubrum (Red maple)
Carya (Hickory)
Fraxinus nigra (Black ash)

The woody understory includes:

Vaccinium corymbosum (Highbush blueberry) - native
Lonicera oblongifolia (Swamp Fly-honeysuckle) - native
Rhamnus frangula (European buckthorn) - exotic
Rhus radicans (Poison ivy) - native

Woody shrubs are invading the upper pond, speeding its eutrophication. *See Figure 45.* I have been unable to access these plants in order to identify them.

A number of fern species make up the bulk of the herbaceous plants in the lowland woods.

Modifications in the lowland woods have been designed with the goal of making the historic/archaeological sites accessible. In order to make accessibility possible, and to prevent further destabilization of the ruins, selective herbicide treatment as indicated in *Figure 40*, is recommended. The new loop trail linking the historic sites, with its spur across the upper dam is the main focus of the lowland woods design. *See Figures 46-47.* This trail and its component elements are shown on

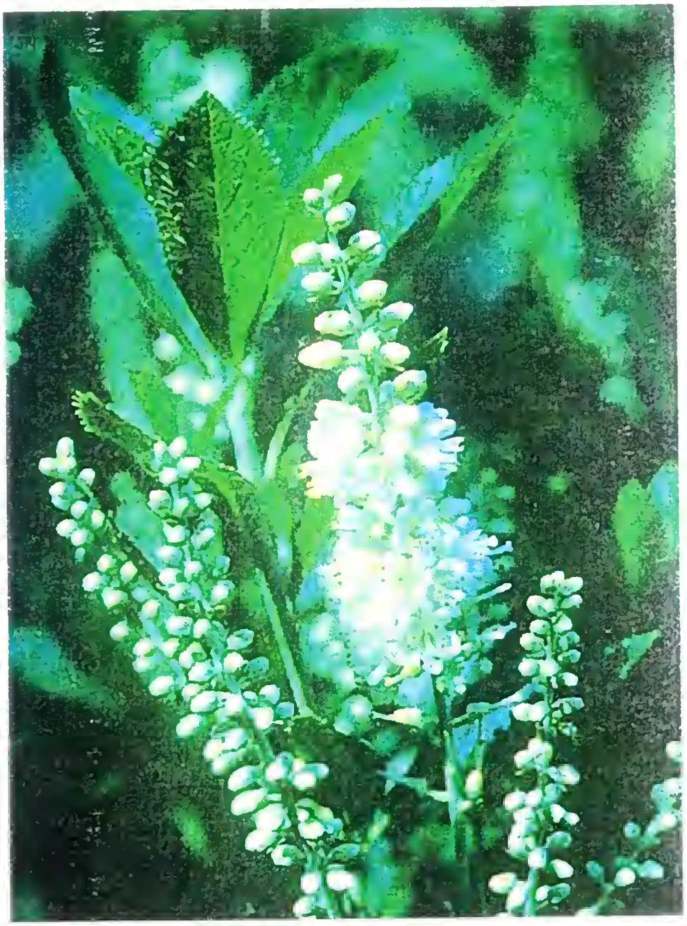

Fig. 41. Sweet Pepperbush (New England Wildflower Society)

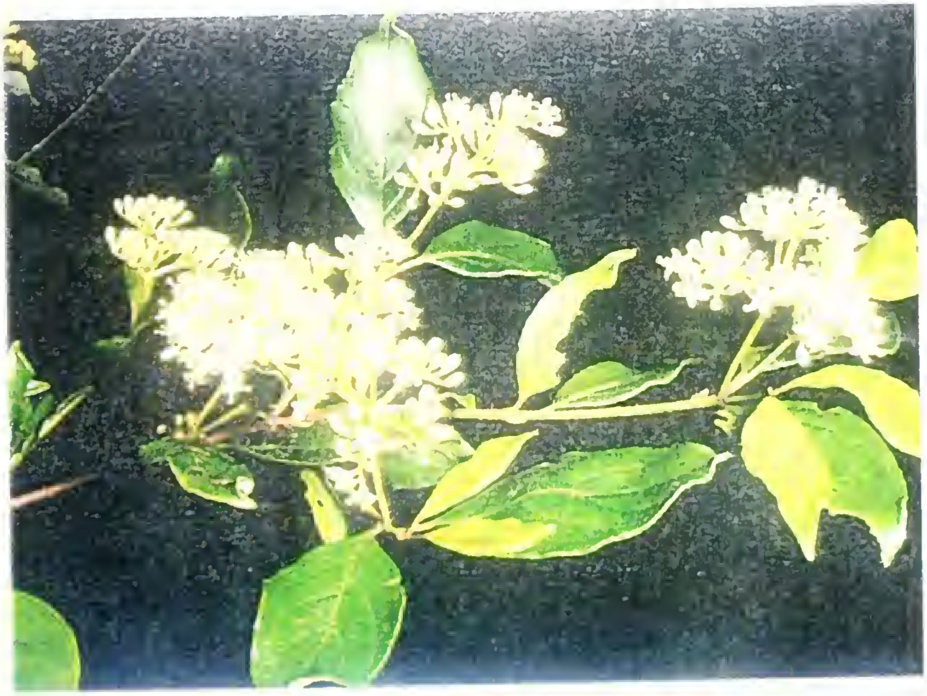

Fig. 42. Gray-bark Dogwood (New England Wildflower Society)

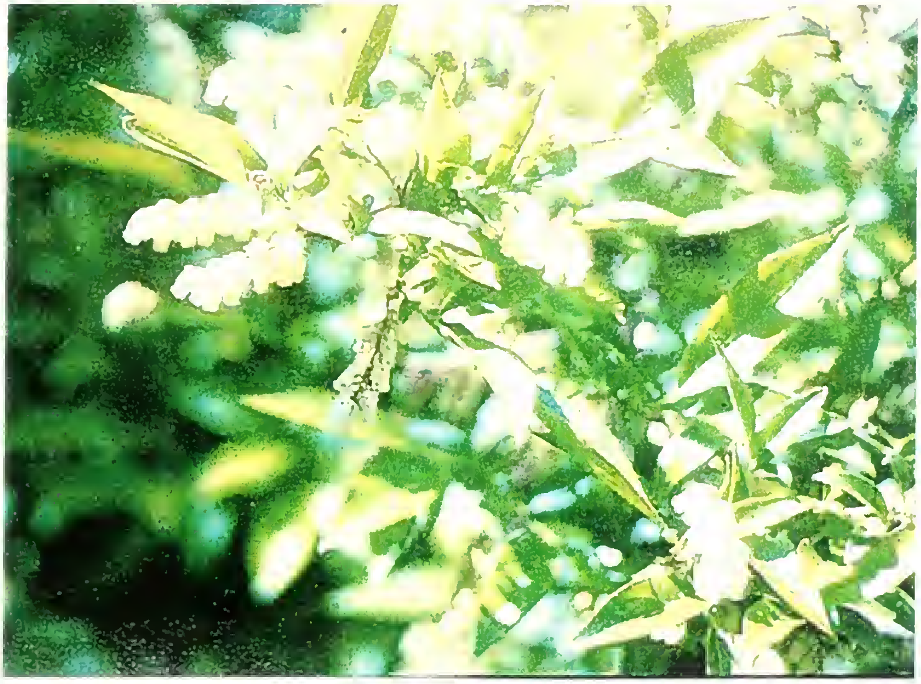

Fig. 43. Fetterbush (New England Wildflower Society)

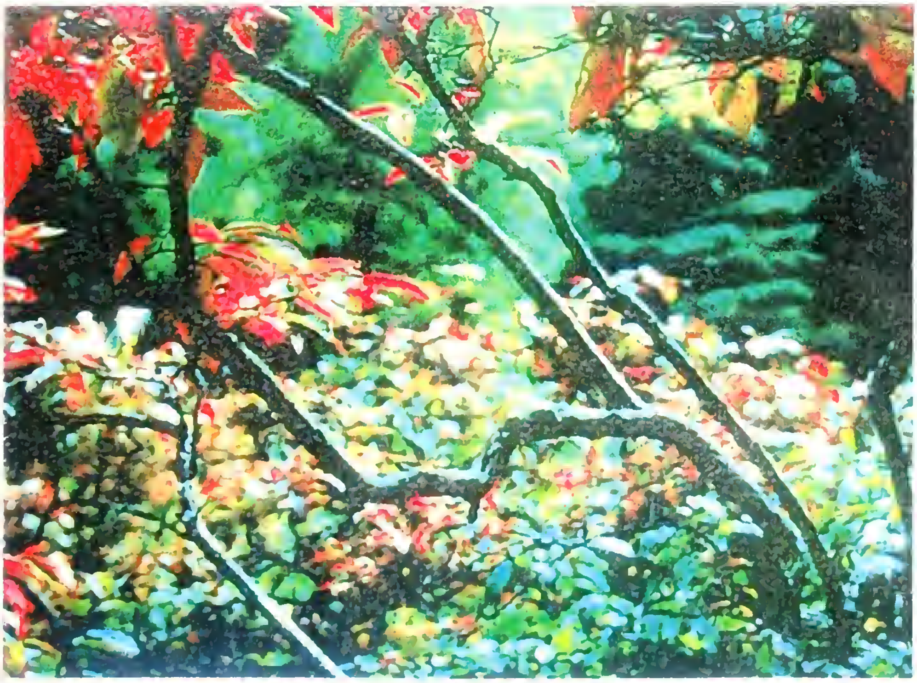

Fig. 44. Highbush Blueberry (New England Wildflower Society)

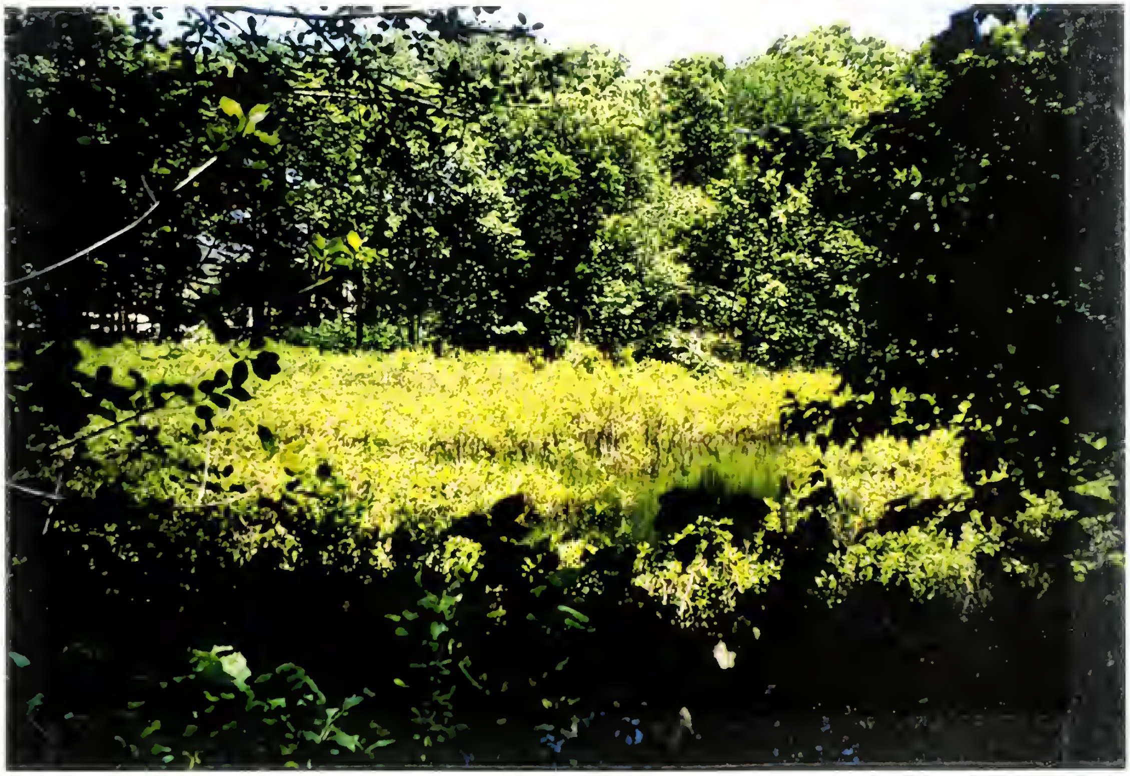

Fig. 45. Upper Pond Eutrophication

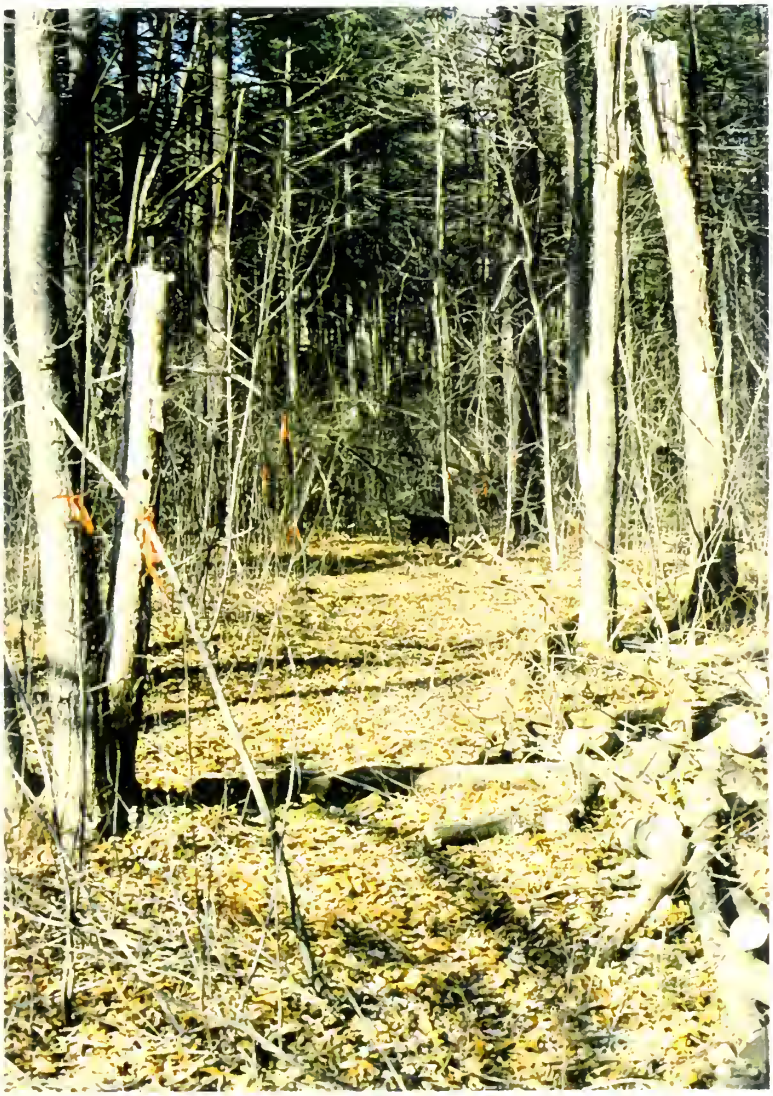

Fig. 46. Lower Loop Trail Through the Woods

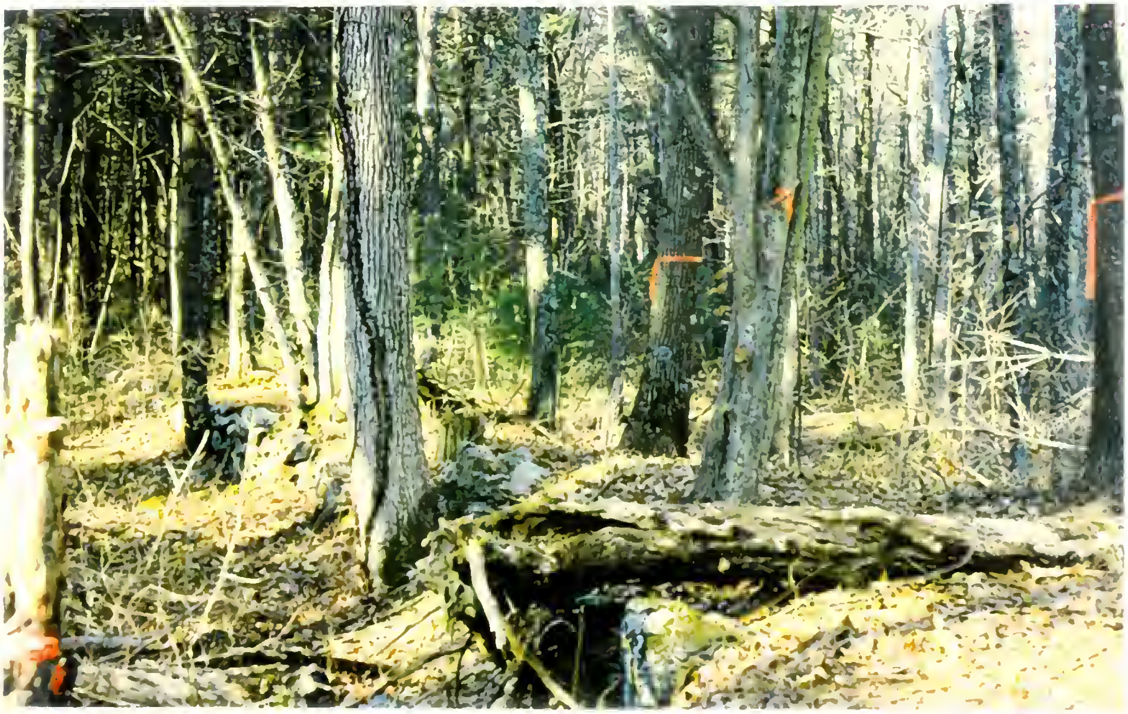

Fig. 47. Lower Loop Trail Ascends the Middle Dam Remnant

the Master Plan Map. *See Figure 27*. Details of the upper historic site design are included in *Figure 13.* The purpose of the streamside trail is to access the upper dams and mill foundations, as well as to provide restful views along the stream between the ponds and offer views of both ponds. The streamside loop trail has been carefully laid out to disturb no living trees or alter any stone walls. A bench will be placed on a scenic point beside the lower pond, as indicated. *See Figures 48-49.* Two simple, rustic bridges will be installed over low areas along the trail. *See Figures 50-51.* A third, more substantial bridge will be placed over the stream as indicated, connecting two parts of the mill foundations. *See Figure 52.* This bridge across the stream is necessary since the best views of the ruins including the power transfer structure are afforded from the east side of the stream. The trees, vines and woody scrub which are reclaiming and burying this site must be cleared to expose and stabilize the ruins.

The second component of the design for the rehabilitation of this Cultural Landscape involves the reconstruction of the lower dam. The histories of the Leland Mill operations, and their importance to the colonial community in Sherborn have been explained earlier in this document. It is vital to retain the historic dam here in order that present and future generations can learn from the site. The lower dam is in need of attention. The dam leaks water continuously. This is evidenced by rivulets that flow through the dam to the west of the main stream. *See Figure 53.* Sometime after the dam washed out in 1920, a reinforced concrete section was appended to the original earth and stone dam, building the dam up to its original height. *See Figure 54.* The only flow out of the lower pond is through an opening in this concrete section. Rehabilitation of this structure must appear to be historically correct, i.e. earth and stone, while meeting current engineering specifications and state and local regulations. It is important for the public to understand both the current political/ecological philosophy in the United States regarding dams and the complex web of regulations which must be adhered to in order to assure perpetual integrity of a dam structure. Following is an explanation of the processes and departments that will be involved in this rehabilitation project.

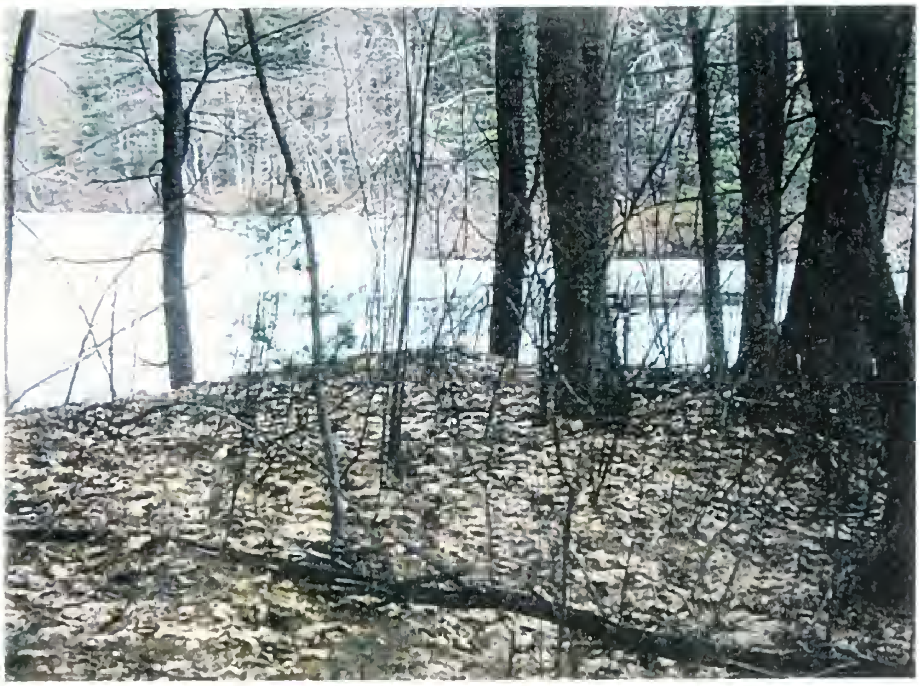

Fig. 48. Reflection Point Beside the Lower Pond

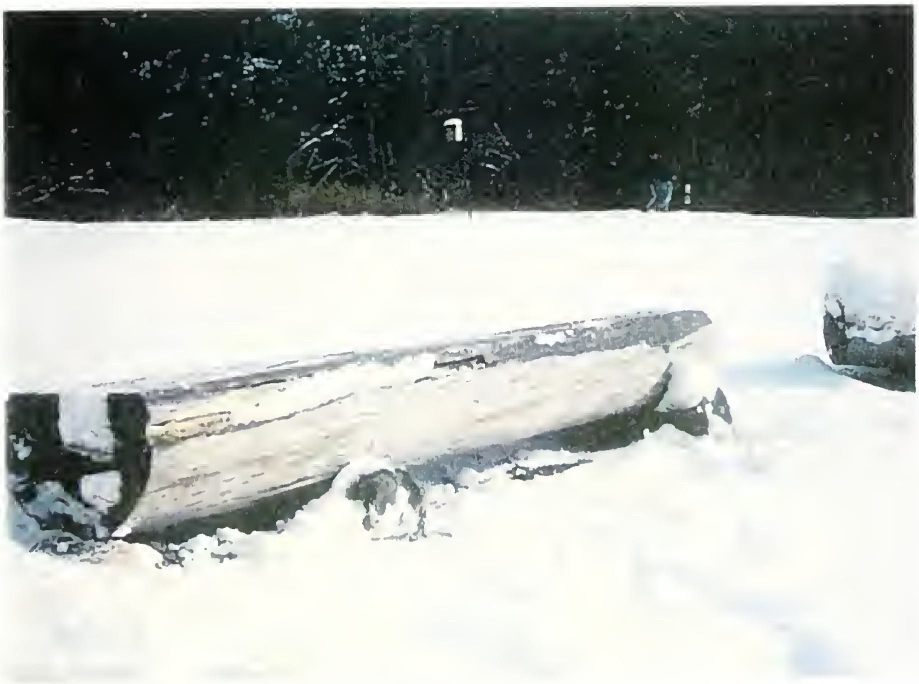

Fig. 49. Log Bench for Reflection Point

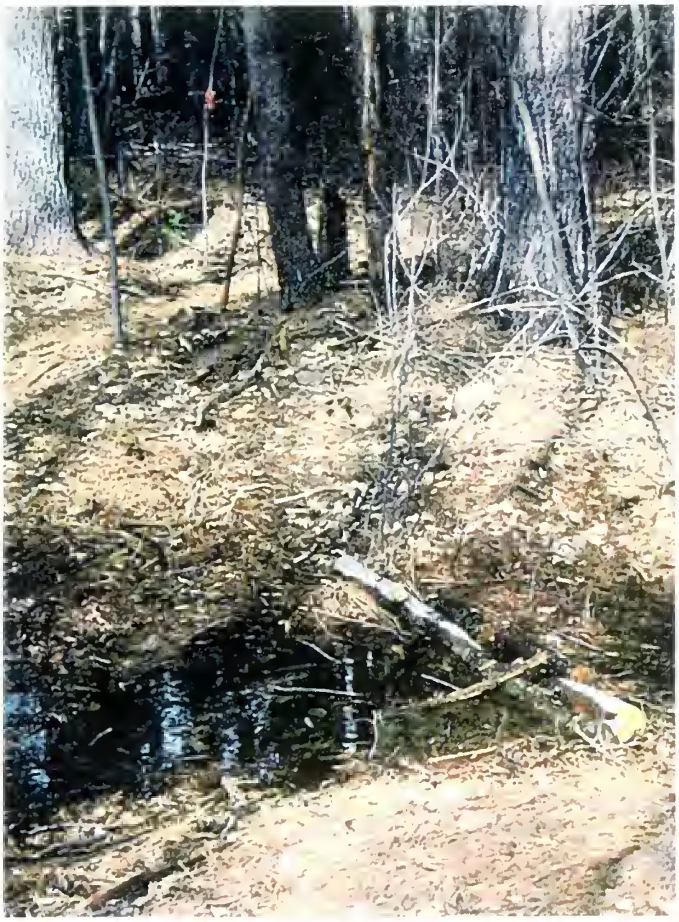

Fig. 50. Low, Wet Area Along the Trail

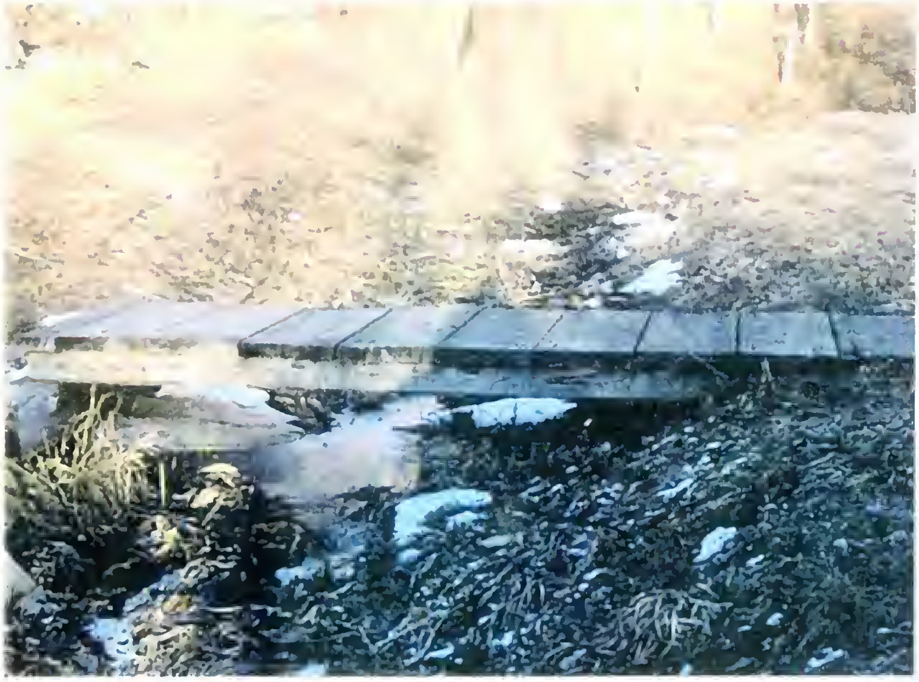

Fig. 51. Bridge to Traverse Low, Wet Trail Areas

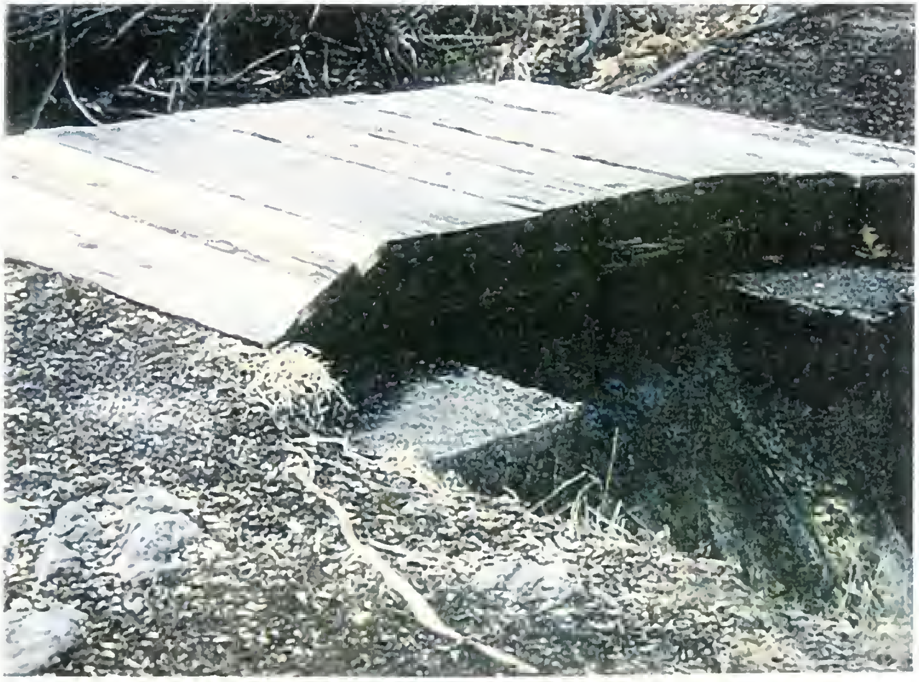

Fig. 52. Bridge for Upper Mill Foundation Stream Crossing

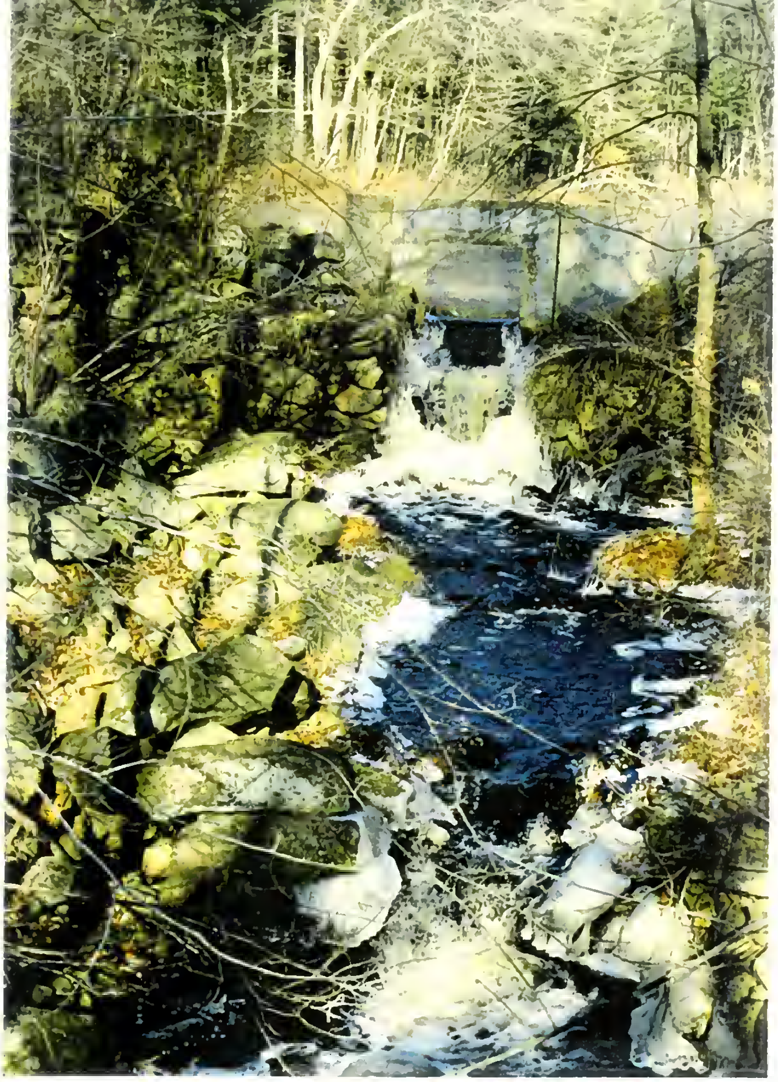

Fig. 53. Ice Forming at Leaks in the Lower Dam

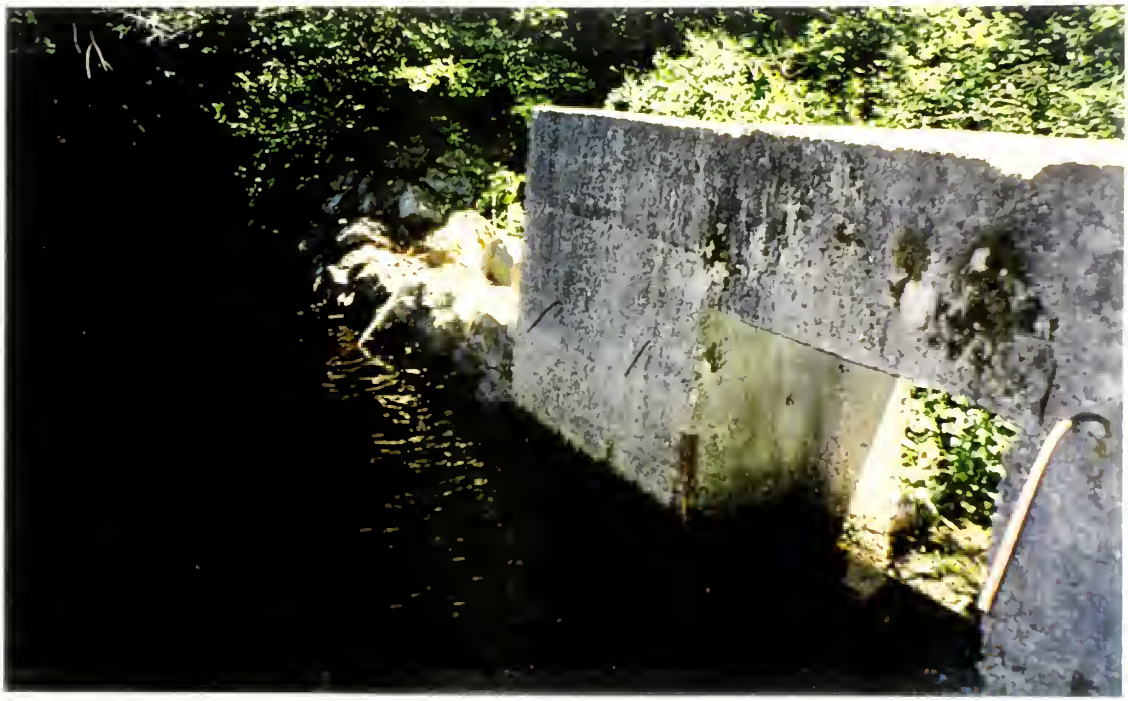

Fig. 54. The Reinforced Concrete Repair to the Lower Dam

In 1982 an analysis of the lower dam was made for the Sherborn Conservation Commission in cooperation with the Middlesex Conservation District.[12] Larry Boutiette was one of two civil engineers who made the analysis. He is now with the USDA Dept. of Natural Resources and Conservation Services. Community Assistance Program. He indicated that since 1982 there has been a turn-around in the Federal Government philosophy regarding dam repairs. Since at some locations dam repairs have led to failures in other parts of older dams, the current philosophy of USDA Dept. of Natural Resources and Conservation Services is to rebuild, not repair dams - due to potential liability.[13]

Larry directed me to Dave Clark at the Department of Environmental Management Dam Safety Department, Lancaster office . DEM records indicate that the lower dam was inspected last July 15, 1973. They list the dam as built in 1830; 4ft. in height; insignificant impact and no hazard. The state requirement is that dams must be inspected every 10 years. I told him that the lower dam is actually eight feet from the top of the dam to its base. They have no record of a second dam. When told that the drop is only three to four feet he surmised that the low drop might be the reason for no record being on file. He then discussed at length the current dam repair/removal philosophy in the nation, which concurred with Larry Boutiette's explanation. He made it clear that with current regulations in place, if a dam is breached by a flood and not repaired/replaced within three years, a town could not get permits to replace it. There is a movement nationwide to remove dams; in fact many cities and towns are doing this,

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[12] Liz McGuire, Middlesex Conservation District,978-692-9395 conversation 1/5/99. I contacted her to determine the relevance of the 1982 engineering study. She outlined the following:

1. A local Conservation Commission determination is necessary for any work to be done; their jurisdiction could involve the DEP. The local ConCom can request of the Middlesex Conservation District that an analysis by USDA Dept. of NRCS such as was completed in 1982 be updated.
2. The DEM Division of Dams and Waterways based in Hingham 781-740-1600, has jurisdiction over all dams in the state in regard to safety/hazzard potential.
3. The US Army Corps of Engineers, located in Concord, MA, has jurisdiction through the Navigable Rivers Act.
4. DEM and the Corps of Engineers would have to approve a repair after a local determination is made.

[13] Larry Boutiette, USDA Department of Natural Resources and Conservation Services, Community Assistance Program, 508-829-6628, phone interview, 1/12/99.

usually driven by a desire to restore the natural ecology of a watershed, particularly the fish habitat.

Dave Clark does not feel that the Leland Dam falls under the jurisdiction of the Army Corps of Engineers as Brown Meadow Brook is not a navigable waterway, just under the DEM and DEP jurisdiction.[14] He indicated that DEM and DEP are trying to work toward greater agreement than they have had in the past in handling dam sites - the former being concerned with safety and hazards, the latter being concerned with even temporary disruption of wetlands during repairs. The local Conservation Commission both must submit state forms for a Request for Jurisdictional Inspection, and for repair work. The required forms are located in Appendices E & F.[15]

Another state agency that could be involved in work at the site is the Massachusetts Historic Commission. If the property becomes a registered historic site, a MHC permit will also be needed for any repairs. The Town of Sherborn is expanding the list of properties that it has registered on the National Register of Historic Places. The local Historic Commission[16] has been having research conducted that has been funded through a grant. The purpose of the grant has been to document properties which would be appropriate to include in an application for inclusion on the State and eventually, National Register.[17] Finally, appropriateness of repair/reconstruction work must be coordinated with respect to the state's archaeological register of the site.[18]

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[14] Regulations regarding dam safety are found in Commonwealth of MA General Laws Chapter 302CMR 10.00. The Department of Environmental Management is the agency responsible for administering this section of the law. A determination by the local Conservation Commission is also necessary for any work in a wetland area. This determination involves the DEP.

[15] Dave Clark, Department of Environmental Management, 508-792-7716, phone interview 1/13/99.

[16] Rob Geary, Chairman of the Sherborn Historic Commission, 508-651-0543, several conversations.

[17] Sanford Johnson, Historic Preservationist, 49B Willowdale Rd., Groton, MA 01450, letter received 3/31/99. He has been hired to conduct research and has included the mills in his survey.

Betsy Friedburg, employee of the State Historic Commission, deals with nominations at the state level. 617-727-8470.

[18] Appendix A, as previously indicated, contains all forms for archaeological registration.

III: Administration

Responsibility for administration of the Leland Mill Reservation falls under the Sherborn Conservation Commission. This has been their responsibility since the Town acquired the property from the Lelands in 1978. It should be quite clear from the discussion above that the Conservation Commission does not, however have exclusive authority for the stewardship of this Cultural Landscape. There are overlapping jurisdictional authority parameters for rehabilitating a Cultural Landscape in the Commonwealth of Massachusetts. A summary of agencies involved in maintenance, repair and restoration of public, historic lands follows:

Local:

1. Conservation Commission
2. Historic Commission

Commonwealth of Massachusetts:

1. Department of Environmental Management
    - Division of Dams and Waterways
2. Department of Environmental Preservation
3. State Food and Agriculture Department Pesticide Bureau
4. State Historic Commission
    - State Register of Historic Places
    - State Register of Archaeological Sites

National:

1. USDA Department of Natural Resources and Conservation Services Community Assistance Programs
2. US Department of Interior Register of Historic Places

Administration and routine maintenance of the Leland Mill Reservation is the sole responsibility of the local Conservation Commission. Severe municipal budget constraints have hampered the hiring of adequately paid administration and maintenance personnel. The Town's priority has been the acquiring of public lands, putting off administration and maintenance. There is a pressing need for regular maintenance of the property if it is not to become more overgrown and is to become accessible to the public. In order for the Master Plan which has been developed to be realized, a phased implementation process needs to begin, in addition to routine maintenance. The section which follows offers suggestions for

administration/maintenance, outlines a phased process for implementation of the master plan, and then addresses the issue of funding sources.

The Trustees of Reservations works with local communities to create acceptable administrative/maintenance policies for their various lands. Different trust agreements are in effect with different properties that TTOR owns and manages. Rocky Narrows is the most popular, widely used property owned and managed by TTOR in Sherborn. Jeff Montgomery[19] heads the staff of three full time employees, which oversees Rocky Narrows and other TTOR properties in Millis, Medfield and Dover. Implementation of some of the TTOR policies for Rocky Narrows could be effective at the Leland Mill Reservation:

1. Opening and closing of gates, as well as policing on the property is the responsibility of the local police. Jeff Montgomery explained that since the Town of Sherborn owns Leland Mill Reservation, all policing is the Town's responsibility.
2. Originally TTOR was run totally by volunteers, but due to today's realities, paid staff is needed for administration/maintenance.
3. Annual trail maintenance - budget constraints force prioritizing of work by TTOR staff. The policy is not to dig out existing grade/subsoil, but to add 2"-3" of crusher run onto trails as needed.[20] With pedestrian and equestrian traffic, the soil compacts in trails and roots are left above the trail grade. Annual addition of crusher run alleviates this condition.
4. Signage to designate property bounds should be installed wherever the trails come close to or cross through the property bound. *See Figure 54.*
5. A kiosk near the park entrance can contain various information about the Reservation for visitors. *See Figure 55.*

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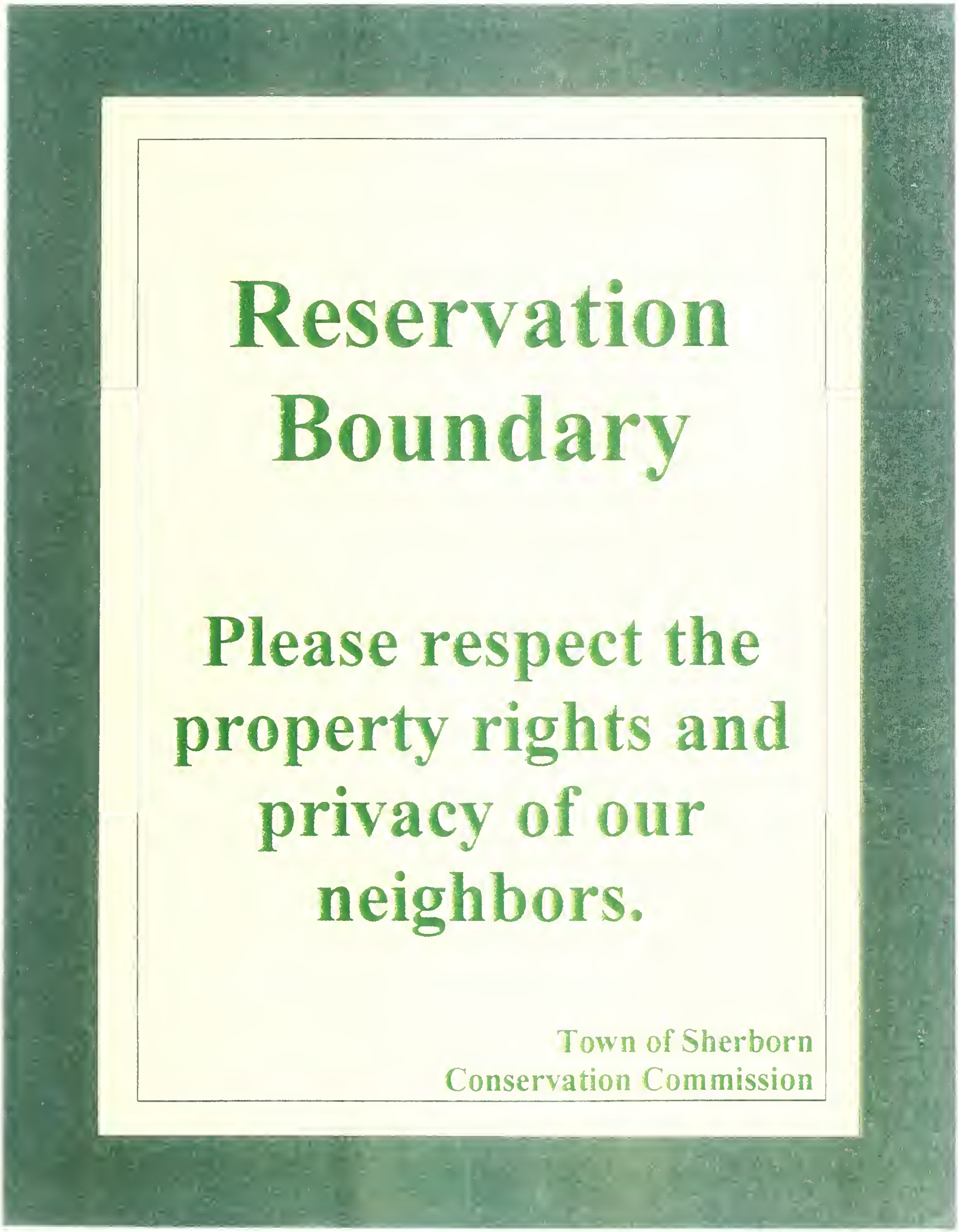
[19] Jeff Montgomery, 785-0339, conversation 4/22/99.

[20] When calculating cost the real cost to put down crusher run, it must be noted that TTOR owns the necessary equipment and has a three person staff paid to install it. Jeff Montgomery further believes that the $1,300 per year per mile cost of trail maintenance estimated by Leonard Phillips in *Parks: Design and Management* (New York: McGraw-Hill, 1996),157 is low.



Reservation Boundary

Please respect the property rights and privacy of our neighbors.

Town of Sherborn
Conservation Commission

Fig. 55. Boundary Sign

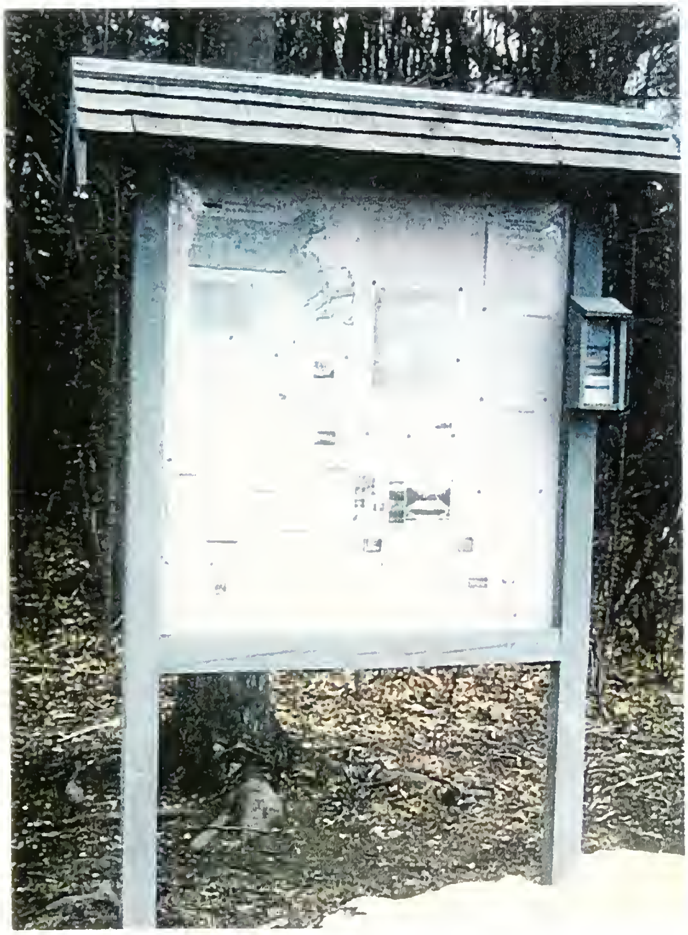


Fig. 56. Kiosk at Rocky Narrows (TTOR)

Management plans for public lands with respect to implementing public relations, responding to vandalism and encouraging volunteerism need to be developed by the Conservation Commission in conjunction with a paid administrator who would oversee the property management. Published suggestions in these three management areas include:

Public Relations: open house, public displays, brochures, local press coverage, cable TV, speakers, newsletters, opinion surveys, inquiries from local residents, citizen activists as allies.[21]

Vandalism: document it, repair promptly, reach persons responsible, and hire them (!), create a vandalism control program[22]

Volunteer programs: coordinate with union Community Maintenance and Development crews, have job descriptions for volunteers, train, supervise, carefully place and recognize the volunteers.[23]

Implementation of the master plan is likely to take many years. Because broad community support is vital, public relations efforts such as those listed above must be a part of each step. It is with the need for community support in mind that the following implementation process for the Master Plan is proposed:

1. Permit public access with off-street parking in order for the public to safely visit this Cultural Landscape.
2. Post boundary signs and erect split rail fences as indicated on Master Plan. *See Figure 27.*
3. Cut and clear the streamside loop trail so that the public can see the upper archaeological site. *See Figure 13.*
4. Treat designated areas with herbicides to make the historic sites accessible and plant as shown. *See Figure 40.*
5. Construct the parking lot and visitor kiosk, and install plantings as shown in *Figure 38.*
6. Cut upper woodland nature trail and begin marking wildflowers. *See Figure 27.*
7. Erect bridge to east side of stream at upper ruins as shown in *Figure 13.*
8. Contract for the engineering and conduct fund raising for lower dam reconstruction and stabilization of mill foundation ruins.

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[21] Phillips, 59-64.
[22] Ibid., 70.
[23] Ibid., 79.

9. Reconstruct lower dam.

In order to adequately administer, conduct routine maintenance and to implement the Master Plan, a substantial funding base beyond tax revenues must be established. Seeking of grants and creation of an endowment for the property's administration and maintenance are realistic goals in Sherborn. The timeliest avenue to pursue for an initial grant is the Sherborn Fund.

This Fund has been established in conjunction with the Town's 325th Anniversary in 1999. George Fiske, founder of the Fund is seeking sample grant requests for civic projects in Sherborn. The purpose of these initial grants will be to highlight the existence of investment opportunities and "good works potentials" offered through the Sherborn Fund.[24] I briefed him on my dam research and my conclusion that an engineering plan is needed for the reconstruction/repair of the lower dam. I suggested that Bob Homer of Lincoln Mill Engineering in Sherborn, a registered Civil Engineer[25] could offer a dollar figure for a grant request. Bob Homer indicated that the first stage in engineering the reconstruction/repair of the dam would be sample soil test borings. Any new engineering plan would be based on these results. There are testing companies that can be hired to do this work. He estimates that ten thousand dollars would be needed to begin this exploratory work. All of the above background has been communicated to the grant writer for the Sherborn Fund.[26]

There are also numerous state and federal grant opportunities for historic and ecological restoration projects. A sample of these grants follows:

-Greenways and Trails Demonstration Grants Program of the DEM.
-Metropolitan Area Planning Council Preservation Projects Fund of MHC.
-Federal Historic Preservation Fund Grants-In-Aid of Nat'l. Park Service.

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[24] George Fiske, conversation 3/2/99. Donations may be made to the Fund, specified in any way the donor chooses, e.g. "for administration of public conservation lands", or unspecified. The goal is to create substantial endowments, whose interest will fund civic projects and programs.

[25] Bob Homer, conversation 3/8/99.

[26] Lu Baker, Grantwriter, conversation 3/8/99.

Many of the state and federal grants are matching fund grants that require property to be registered as historic to begin the qualification process. Projects must compete for a limited source of funds. I have been unable at this time to determine whether Sherborn could realistically qualify for state or federal grants.

IV: Conclusions

The conservation property in Sherborn that is the Leland Mill Reservation is a unique Cultural Landscape in the town. It is the only publicly held property in Sherborn which contains colonial mill dams and accompanying mill foundation ruins. The mills on the coastal plain were an important element in the rural history of 19th century New England. The Leland mills, if accessible, will be a significant outdoor history classroom for all ages. The two mill ponds have become meccas for a wide variety of wildlife - both resident and migratory. In order for this site to be preserved both historically and ecologically, both for the education and enjoyment of the populace while remaining an inviting home for wildlife, I have developed this Master Plan.

I have been delighted with the positive community response to this project, both from individuals and especially from the Sherborn Conservation Commission. At the time of this writing, the entrance gate has been relocated back from the road permitting off street parking, the streamside loop trail has been cleared by one citizen[27], and discussion has begun regarding signage, the parking lot, and herbicide treatment. Concerns have been voiced by some regarding any change, but the majority of feedback has been most enthusiastic for the continuance of the project.

I hope that the timing of the town's 325th celebration this year and the kick-off of the Sherborn Fund with its initial grants will be a successful beginning of local fundraising for this Cultural Landscape. Without the infusion of significant funds, the property will eventually evolve back to feature the woodland stream that pre-dated the ponds and aggressive, invasive vegetation that will choke out desirable natives.

Finally, I hope that the process of making the Leland Mill Reservation accessible to the public and a property that is actively administered and maintained will serve as a model for the management of other public properties. Our publicly owned, publicly purchased properties are treasures to be shared. I plan to remain actively involved in seeing through the implementation of the Master Plan[28]

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[27] Ed Perry,citizen volunteer, cleared the entire west side trail.

[28] John Furlong, speaking in Design III 1/99 advised that for civic projects to be realized it is up to the designer to push the process.

in order that the Leland Mill Reservation will become an attractive site for passive recreation, reflection and historic education, while remaining a lush wildlife habitat.

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Appendix A: Application Forms for Prehistoric and Historic Archaeological Sites

The Commonwealth of Massachusetts
William Francis Galvin, Secretary of the Commonwealth
Massachusetts Historical Commission

How to Complete a D Form -- Prehistoric and Historic Archaeological Sites

Attached are excerpts from the Massachusetts Historical Commission's *Historic Properties Survey Manual: Guidelines for the Identification of Historic and Archaeological Resources in Massachusetts* (1992, reprinted 1993).

This packet includes step-by-step instructions for recording prehistoric archaeological sites (using MHC Form D) and historic archaeological sites (using MHC Form D-HA). Also included are general guidelines for completing MHC inventory forms, and *Survey Technical Bulletin #1*, which addresses certain technical issues in producing the forms.

For additional information or assistance, contact MHC staff archaeologists.

The *Historic Properties Survey Manual* and *Survey Technical Bulletin #1* have been financed in part with Federal funds from the National Park Service, U. S. Department of the Interior. However, the contents and opinions do not necessarily reflect the view or policies of the Department of the Interior.

This program receives Federal funds from the National Park Service. The U. S. Department of the Interior prohibits discrimination on the basis of race, color, national origin, age, gender, or handicap in its Federally assisted programs. If you believe you have been discriminated against in any program, activity, or facility as described above, or if you desire further information, please write to:

Office for Equal Opportunity
U. S. Department of the Interior
1849 C Street NW, Room 1324
Washington, D. C. 20240

220 Morrissey Boulevard, Boston, Massachusetts 02125 · (617) 727-8470

How to Complete a D Form -

Prehistoric and Historic Archaeological Sites

Any below-ground resources should be recorded on D Forms. Identifying and recording archaeological sites generally requires professional assistance, and should not be attempted by untrained or unsupervised volunteers. Because of the vulnerabilty of archaeological sites to looting, their location, as well as any records pertaining to them, should be kept confidential. For additional information on identifying archaeological resources in your community, contact the Massachusetts Historical Commission.

Surveys of archaeological sites are undertaken at the reconnaissance or the intensive level. Reconnaissance level surveys are designed to identify archaeologically sensitive areas. Although not designed to identify all archaeological sites within a particular area, some sites may be found as a result of the reconnaissance survey. Archaeological sites identified at the reconnaissance level are generally documented through background research and visual examination, rather than excavation. Site locations may frequently be determined through documentary sources such as historic maps, deeds, town histories, or newspapers. Interviews with knowledgeable individuals may also produce information on known or suspected site locations. Visual inspection of site locations identified through these means may provide field evidence for their existence through the survival of cellar holes, foundations, depressions, dams, artifacts, or other features. Field inspection also provides the basis for a description of the site location and its condition.

Intensive level surveys are designed to include both detailed above-ground and below-ground examination of an area. They are designed to locate specific sites within areas determined archaeologically sensitive through reconnaissance level survey. Intensive level surveys include all the components of a reconnaissance level survey, with the addition of test excavations to identify the presence of buried artifacts or features.

Archaeological surveys should include a report that includes a description and justification of the research design, methodology, and research techniques used. Professionally-conducted surveys should also follow a detailed project scope-of-work.

Under Massachusetts law, permits from the State Archaeologist are required for scopes-of-work for all Reconnaissance Survey, Intensive Survey, Site Examination, and Data Recovery projects. The State Archaeologist regulations

require site forms to be completed as part of all scopes.

Further Reading:

Public Planning and Environmental Review: Archeology and Historic Preservation. Boston: Massachusetts Historical Commission, 1985.

Archeological Field Investigation Regulations (950 CMR 70.00) available from the Massachusetts Historical Commission.

FORM D - PREHISTORIC ARCHAEOLOGICAL SITE

Categories with a * must be completed.

*1.	SITE NAME(S)	Primary or common name(s) associated with the site. Sites are often named after landowners, streets or conspicuous topographic features (land forms, water bodies, rivers) in the immediate vicinity.
	MAS NO.	The inventory number given a site by the Massachusetts Archaeological Society (MAS).
	OTHER NO.	Site number(s) assigned by other institutions or individuals during specific surveys or as part of an overall regional inventory.
*2.	TOWN/CITY	Name the town or city in which the site is located. In instances where a site straddles town boundaries, list all towns, listing the town that includes the majority of the site first.
*	COUNTY	Indicate the county in which the site is located.
*3.	STREET AND NUMBER	Indicate the address where the site is located. If the site is not in close proximity to a road, give a detailed description of how to reach it.
*4.	OWNER(S) AND ADDRESS(ES)	Indicate the owner(s) of the site and their mailing address(es). Note whether ownership is public or private.
5.	SITE LOCATED BY	Indicate whether the site was found by a CRM Survey, Avocational Collector, Field School or other means. Cultural Resource Management (CRM) surveys are usually conducted by professionals under permit with the State Archaeologist. Avocational Collectors are individuals in amateur societies such as the Massachusetts Archaeological Society. Field Schools are educational programs which teach individuals the methods and techniques

of archaeological fieldwork. If the site was located by a different means, check other and specify. "Other" includes random finds of cultural material, for example, during a construction project, while gardening, or while walking along the beach. "Other" may also refer to government surveys, literature searches or interviews. Sampling Strategy used to locate the site may include surface survey excavation and auguring. If possible, specify whether the strategy was judgmental or random.

***6a. PERIOD(S)**

Indicate the relative age or culture period(s) found at the site. These periods are explained in numerous professional and amateur publications. Please refer to the MHC Guide to Prehistoric Site Files and Artifact Classification System. If you do not know the culture period check "unknown".

***6b. ESTIMATED OCCUPATION**

Note the total time the site was occupied, for example, Middle Archaic, (ca. 8,000 to 6,500. B.P.) through Late Woodland (1,300 to 400 B.P.) or a period of 6,000 to 7,000 years.

Boxes are also provided to indicate whether the site is single or multi-component. These identifications refer to the number of culture groups and/or tool technologies represented at the site. A space is provided to specify all components. For example, Middle Archaic can include Neville and/or Stark components while the Late Woodland can include a Levanna component.

7. DATING METHODS

Specify the method(s) used to date the site. If a C14 date is available, list the date, standard deviation, and lab number. Note if the date was C13 corrected. If the site was dated through the use of comparative materials, list the materials. For example, Vinette I ceramics might indicate an Early Woodland component.

8. **DESCRIBE SITE TYPE/ FUNCTION**	List all known site types and functions at the site Site types may include burials, campsites, find spots, habitation sites, quarries or shell middens. Site functions might include activities such as fishing, lithic extractions and/or manufacture, or food processing.
*9. **DESCRIBE SIZE AND HORIZONTAL AND VERTICAL BOUNDARIES**	Describe the overall size of the site in square feet/meters or acres/hectares. Landforms such as hills, rivers or knolls may also be discussed as they relate to the site's horizontal extent. Also include vertical site boundaries, if known (for example, from 0 to 40 cm below surface).
10. **GENERALIZED SITE PROFILE**	Draw soil horizons, texture and respective depths in the block provided. Indicate levels and depths of cultural material.
11. **SOIL**	Describe characteristics of the site's ground surface and soils. USDA Soil Series refers to the categories identified by the county soil surveys of the United States Department of Agriculture (USDA) Soil Service. Contour elevation may be determined from USGS topographic maps or, if available, engineering drawings. Ground slope may also be obtained from USDA soil maps, but may also be approximated from visual inspection in the field. Soil acidity may be obtained from USDA soil surveys.
12. **TOPOGRAPHY**	Characterize the land surface (flat, gentle undulation, rolling hills, or mountains).
*13. **WATER**	Describe the water sources in closest proximity to the site. The nearest water source could be a lake, pond, stream, freshwater wetland, or saltmarsh. Note the size of the water source. Note also the

	seasonal availability of the water source, for example, year round or spring only.
14. VEGETATION	Describe the present vegetation of the site. Discuss tree growth, understory and grass cover. Past vegetation may be determined through consulting regional/local pollen diagrams and soil types.
*15. SITE INTEGRITY	Describe the present condition of the site (undisturbed, good, fair, or destroyed).
*16. SURROUNDING ENVIRONMENT	Describe the cultural and natural environment around the site. Note natural factors such as open land, woodland, eroded soils, coastal or isolated. Cultural factors that describe the local environment may include commercial, industrial, residential, and rural. Also note if scattered buildings are visible from the site.
*17. ANY THREATS TO SITE (DESCRIBE POTENTIAL THREATS)	Indicate whether or not a threat exists. Describe any existing threats. Possible threats include residential or roadway construction, erosion and pothunting.
*18. ACCESSIBILITY TO PUBLIC	Indicate whether access is unrestricted, owner permission is needed, access is restricted, or no access is available.
*19. PREVIOUS WORK	Summarize work performed at the site to date. Note whether the site was surface-collected, "pot-hunted," tested, or excavated. Indicate in each case the name and affiliation of the person or group performing the work. Also note the date on which the activity took place.

20. **PRESENT LOCATION OF MATERIALS (INCLUDE ADDRESSES)**	Note the location of any artifacts recovered from the site. Materials may be located with institutions or individuals.
*21. **REFERENCES/ REPORTS**	Cite fully any publications or reports that describe or analyze this site or its material.
*22. **RECOVERED DATA**	Describe any cultural materials recovered from the site. These may include projectile point types, other artifactual materials, features, and other kinds of formations such as floral and faunal remains.
*23. **ARCHAEOLOGICAL OR HISTORICAL SIGNIFICANCE**	Summarize the archaeological and historical importance of the site. Include research questions that help explain how this site contributes to an understanding of local and regional patterns of development.
*24. **ATTACH PORTION OF USGS QUAD WITH SITE AREA MARKED TO THIS FORM**	An original or reproduced copy of a USGS quadrangle map with the site area clearly marked MUST BE INCLUDED WITH THE SITE FORM. If a section of the USGS map is included, it should be labeled with the name of the quadrangle.
*25. **SKETCH PLAN OF SITE**	Draw a sketch plan of the site. The plan should include a north arrow, scale, and important or conspicuous landmarks that help locate the site and its most important features.
26. **PHOTOS**	If available, photos of the site may be attached to the site form. All photos should include the date of

photo, the photographer's name, view shown, and the name and location of the site.

REPORTED BY: Indicate the name, address, organization of the person who filled out the site form, and the date that the form was completed.

FORM D - ARCHAEOLOGICAL SURVEY
PREHISTORIC ARCHAEOLOGICAL SITES

Massachusetts Historical Commission
Office of the Secretary
State House, Boston

FOR MHC OFFICE USE ONLY

Town
MHC NO.
UTM / / / / / / / / / / / / / / / / / / /
ZONE EASTING NORTHING
QUAD
NR ☐ACT ☐ELIG. ☐NO DISTRICT ☐yes ☐No

IDENTIFICATION

1. SITE NAME(S) Bay Street I
MAS NO. M39-NE-88 OTHER NO. 7KP

2. TOWN/CITY Taunton
COUNTY Bristol

3. STREET & NUMBER (IF NOT AVAILABLE, GIVE DETAILED DESCRIPTION OF HOW TO REACH SITE)
site was previously located on a knoll overlooking Snake River on the north side of the I-495 right-of-way immediately east of Exit 9 and north of Bay Street

4. OWNER(S) AND ADDRESS(ES)
Massachusetts Department of Public Works, Boston, Massachusetts
☒Public ☐Private

5. SITE LOCATED BY
☒CRM Survey ☒Avocational Collector ☐Field School ☐Other (Specify)
Describe Sampling Strategy used to Locate Site:

DESCRIPTION

6a. PERIOD(S) (Check all applicable boxes)
☐Paleo ☐Early Archaic ☒Middle Archaic ☒Late Archaic
☒Early Woodland ☒Middle Woodland ☐Late Woodland
☐Contact ☐Unknown ☐Other (Specify)

☐Single Component ☒Multi-Component
Specify All Components

Stark	Brewerton	Atlantic
Neville	Small Stem	Orient
Vosburg	Squibnocket	Levanna
		Vinette

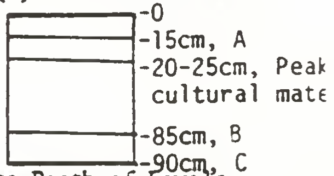
6b. Estimated Occupation Range 8,000-1800 B.P.

7. DATING METHODS C-14 16 C14 Dates ☐Intuition ☒Other (Specify)
Comparative Materials various types of projects points and ceramics

8. DESCRIBE SITE TYPE/FUNCTION
large residential base camp type site

9. DESCRIBE SIZE AND HORIZONTAL & VERTICAL BOUNDARIES
Site occupies a large knoll/peninsula jutting into the Snake River which forms the northern site boundary. The site is approximately 4.59 acres or 1.87 hectares in size. Vertically, the site extends from the surface to a depth of at least 95cm.

10. GENERALIZED SITE PROFILE
Type of Soil(s) Cultural Material



Indicate Depth of Levels

ENVIRONMENT

11. SOIL USDA Soil Series
Contour Elevation 60-90 ft.
% Slope of Ground ☐0-5 ☒5-15 ☐15-25 ☐over 25
Acidity 1 ——7—— 14 (Acid) (Base)

12. TOPOGRAPHY
☐Flat ☒Gentle undulation ☐Rolling Hills ☐Mountains

13. WATER NEAREST WATER SOURCE Snake River
SIZE AND SPEED
DISTANCE FROM SITE 0
SEASONAL AVAILABILITY year round

14. VEGETATION PRESENT Second growth pine look prior to destruction
PAST

CONDITION

15. SITE INTEGRITY
☐Undisturbed ☐Good ☐Fair ☒Destroyed
IF DISTURBED, DESCRIBE DISTURBANCE
Original relatively undisturbed except for a dirt road along western boundary and som riverine erosion

16. SURROUNDING ENVIRONMENT
☐Open Land ☐Commercial ☐Coastal
☒Woodland ☐Industrial ☐Isolated
☐Eroded Soils ☐Residential ☐Rural
☐Scattered Buildings Visible from Site

17. ANY THREATS TO SITE DESCRIBE POTENTIAL THREATS: DESCRIBE
☒Yes ☐No site has been destroyed by highway construction

18. ACCESSIBILITY TO PUBLIC
☐Free Access ☐Need Owner Permission ☒Restricted ☐No Access

12/82

RESEARCH STATUS

19. PREVIOUS WORK ☐ Surface Collected	BY WHOM/AFFILIATION	DATE
☐ "Pot hunted"	BY WHOM/AFFILIATION	DATE
☒ Tested	BY WHOM/AFFILIATION Clough Survey, Public Archaeology Laboratory, Brown University, Providence, R.I.	DATE 1975 1977
☒ Excavation	BY WHOM/AFFILIATION Public Archaeology Laboratory, Brown University, Providence, R.I.	DATE 1980

20. PRESENT LOCATION OF MATERIALS (INCLUDE ADDRESSES)
Department of Anthropology, Brown University, Providence, R.I.

21. REFERENCES/REPORTS
Clough (1975) Thorbahn (1977) Thorbahn (editor) (1982)

Moran (1976) Thorbahn and Moran (1978)

SIGNIFICANCE

22. RECOVERED DATA (identify in DETAIL, including features, pits, burials, faunal material, et

Over 10,000 pieces of cultural material including projectile points, knives, scrapers, hammerstones, blanks/point preforms, bifacial tool blades, ground stone fragments, ceramic calcined bone, guano, shell, floral remains, drills, ulus, atl atl weights, chipping debri burnt rock. Numerous features (59) were also recovered including charcoal pits, hearths and soil stained pits.

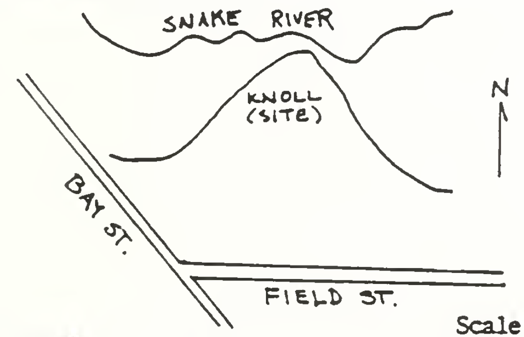
23. ARCHAEOLOGICAL OR HISTORICAL SIGNIFICANCE

The environmental setting, good stratigraphy and originally undisturbed condition of t large multicomponent site makes it unique in southern New England. The site presents an unlimited opportunity for the study of subsistence and settlement activities on a broad scale within the Taunton River basin, particularly when contrasted against other systematically excavated sites found within the I-495 corridor.

SITE PLAN

24. ATTACH PORTION OF USGS QUAD WITH SITE AREA MARKED TO THIS FORM

25. SKETCH PLAN OF SITE



Scale: 1:25000

26. PHOTOS: Attach if available
Label each with: Date of photo, photographer, view shown, name of site.

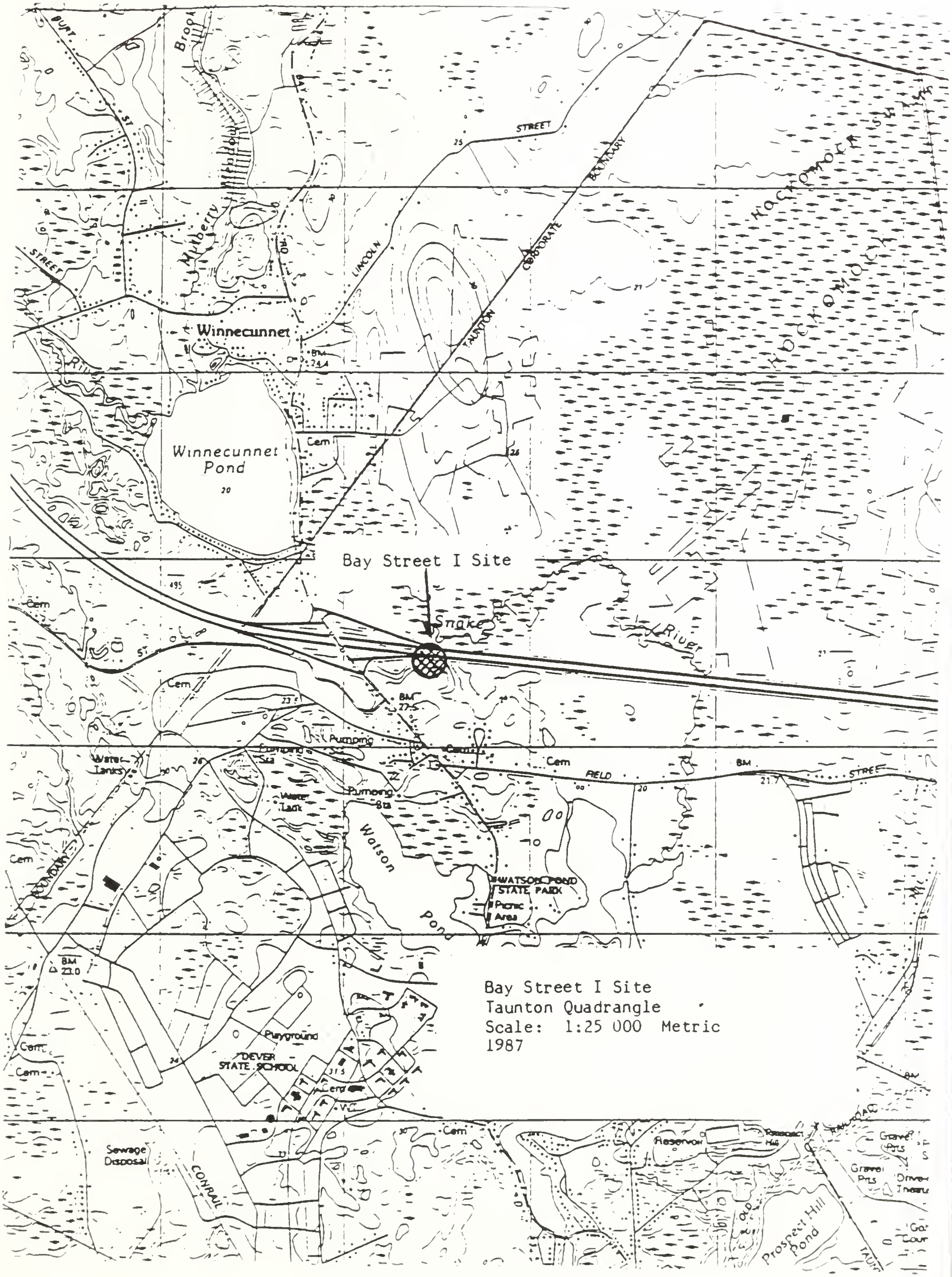
EPORTED BY:
NAME John Smith
ADDRESS 14 Washington Street, Taunton, MA
ORGANIZATION
DATE 6/1/82

FOR OFFICE USE ONLY

IELD EVALUATION

OMMENTS

12/82



Bay Street I Site
Taunton Quadrangle
Scale: 1:25 000 Metric
1987

FORM D (HISTORIC ARCHAEOLOGICAL SITE)

Categories with a * must be completed.

*1.	SITE NAME(S)	Primary or common name(s) associated with the site. Sites are often named after landowners, streets, or conspicuous topographic features (land forms, water bodies, streams) in the immediate vicinity.
	MAS NO.	The inventory number given a site by the Massachusetts Archaeological Society (MAS).
	OTHER NO.	Site number(s) assigned by other institutions or individuals, usually during specific surveys or as part of an overall regional inventory.
*2.	TOWN/CITY	Name the town or city in which the site is located. In instances where a site straddles town boundaries, list all towns, listing the town that includes the majority of the site first.
*	COUNTY	Indicate the county in which the site is located.
*3.	STREET AND NUMBER	Indicate the address where the site is located. If the site is not in close proximity to a road, give a detailed description of how to reach it.
*4.	OWNER(S) AND ADDRESS(ES)	Indicate the owner(s) of the site and their mailing address(es). Note whether ownership is public or private.
5.	SITE LOCATED BY	Indicate whether the site was found by: a CRM Survey, Avocational Collector, Field School or other means. Cultural Resource Management (CRM) Surveys are usually conducted by professionals under permit with the State Archaeologist. Avocational collectors are private individuals in avocational societies such as the Massachusetts Archaeological Society. Field Schools are educational programs which teach the methods and

techniques of archaeological fieldwork. If the site was located by a different means, check Other and specify. Other includes random finds of cultural material, for example during a construction project, while gardening or while walking along the beach. Other may also refer to government surveys, literature searches, or interviews. Sampling strategy used to locate the site might include surface survey, excavation, or auguring. If possible, specify whether the strategy was judgmental or random.

***6a. PERIOD(S)**

Indicate the time period(s) represented at the site. Any or all boxes of appropriate periods should be checked. Check "unknown" if the time period at the site can not be identified.

***6b. ESTIMATED OCCUPATION RANGE**

Estimate the time period during which the site was occupied. For example, the site may have been occupied from the mid-17th to early 19th century (approximately 150 years). Two or more occupation ranges might be noted if the site was abandoned for a period of time.

***7. DATING METHOD**

Describe methods used to date the site. Historic maps may be used when the presence or absence of a structure or roadway infers a date. Title searches may also indicate land ownership and the presence of structures. "Yes" or "no" box must be checked indicating whether or not a title search has been completed. Additional documents such as tax lists or probate records may also provide dates for structures and/or land ownership. List these documents if they are known. Dates can also be inferred through comparison of material found on the site with materials whose period of manufacture and use are well documented. Common comparative materials include: ceramics, glassware, nails, and smoking pipes. Space is provided in the event that other research methods were used to date the site.

***8a. SITE TYPE**	A box is provided to indicate whether the site is Agrarian, Residential, Industrial, Commercial, Military, Unknown or Other. If the last is checked, specify the nature of the site.
***8b. DESCRIBE**	Briefly describe the site. Include the number of structures, foundations, or cellar holes as well as their general layout and size. Note the presence of trash pits, privies, wells, dams, mill races, or forges.
***9. DESCRIBE SIZE AND HORIZONTAL AND VERTICAL BOUNDARIES**	Describe the overall size of the site in square feet/meters or acres/hectares. Discuss landforms, such as hills, rivers or knolls as they relate to the site's horizontal extent. Include vertical site boundaries, if known (for example from 0 to 40 cm below surface).
10. STRATIGRAPHY	Describe surface indicators of cultural remains and whether or not stratigraphy is present. Indicate whether the site was identified through standing ruins, surface finds, markers, or cellar holes. Indicate whether the site is stratified or not stratified.
11. SOIL	Describe the characteristics of the site's ground surface and soils. USDA Soil Series refers to the cateories identified by the county soil surveys of the United States Department of Agriculture Soil Service. Contour elevation for a site may be determined from USGS topographic maps. Slope of ground may also be obtained from USDA soil maps, or may be approximated from visual inspection in the field. Soil acidity may be obtained from USDA soil surveys.
***12. TOPOGRAPHY**	Characterize the land surface. A box may be checked for flat, gentle undulation, rolling hills, or mountains.
***13. WATER**	Indicate the type of water source in closest proximity to the site (for example: lake, pond, stream, freshwater wetland, or saltmarsh). Note the size of

	the water source. Also note the seasonal availability of the water source (for example year round or spring only).
14. VEGETATION	Describe the present and past vegetation of the site. Discuss tree growth, understory, and grass cover. Past vegetation may be determined through consulting regional/local pollen diagrams and soil types.
*15. SITE INTEGRITY	Describe the present condition of the site (undisturbed, good, fair, or destroyed).
*16. SURROUNDING ENVIRONMENT	Describe the cultural and natural environment around the site. Note natural factors such as open land, woodland, eroded soils, coastal or isolated. Note cultural factors in the local environment, including commercial, industrial, residential, or rural uses. Also indicate if buildings are visible from the site.
*17. ANY THREATS TO SITE (DESCRIBE POTENTIAL THREATS)	Indicate whether or not a threat exists. If yes describe the threat in detail. Possible threats include residential or roadway construction, erosion, and pothunting.
*18. ACCESSIBILITY TO PUBLIC	Indicate whether access is unrestricted, owner permission is needed, access is restricted, or no access is available.
*19. PREVIOUS WORK	Summarize work performed at the site to date. Note whether the site was surface-collected, "pot-hunted," tested, or excavated. Indicate the name and affiliation of the person or group who performed the work, and the date on which the activity took place.

20. PRESENT LOCATION OF MATERIALS (INCLUDE ADDRESSES)	Note the location of any artifacts recovered from the site. Materials may be located at institutions or with an individual.
*21. REFERENCES/ REPORTS	Cite any publications or reports that describe or analyze the site or its materials.
*22. RECOVERED DATA	Describe information from both documentary and archaeological sources in detail. Documentary data may indicate structures or landscape features no longer visible. Documentary data may also provide details that describe these features and their locations. Archaeological data may include artifacts or structures.
*23. ARCHAEOLOGICAL OR HISTORICAL SIGNIFICANCE	Summarize the archaeological and historical importance of the site. Include a discussion of research questions that explain how the site contributes to an understanding of local and regional patterns of history.
*24. ATTACH PORTION OF USGS QUAD (WITH SITE AREA MARKED) TO THIS FORM	An original or reproduced copy of a USGS quadrangle map with the site area clearly marked MUST BE INCLUDED WITH THE SITE FORM. If a section of the USGS map is included, it should be labeled with the name of the quadrangle.
25. SKETCH PLAN OF SITE	A sketch plan of the site is drawn in this section. The plan should include a north arrow, scale, and important or conspicuous landmarks that help locate the site and its most important features.

26. PHOTOS	If available, photo(s) of the site can be attached to the site form. All photos should include the date of photo, the photographer's name, view shown, and the name and location of the site.
REPORTED BY	The last section to be filled out indicates the name, address, organization of the person who filled out the site form, and the date the form was completed.

ORM D - HISTORIC RESOURCES SURVEY
ISTORIC ARCHEOLOGIC SITES
assachusetts Historical Commission
Office of the Secretary
State House, Boston

FOR MHC OFFICE USE ONLY

Town MHC NO.
UTM /
ZONE EASTING NORTHING
QUAD
NR ☐ACT ☐ELIG. ☐NO DISTRICT ☐yes ☐No

1. SITE NAME(S) Sawmill & Dam Site
MAS NO.
OTHER NO. 7DH (Brown Univ. PAL)

2. TOWN/CITY Norton
COUNTY Bristol

3. STREET & NUMBER (IF NOT AVAILABLE, GIVE DETAILED DESCRIPTION OF HOW TO REACH SITE)
In Route 123 interchange area of I-495, south side, near the highway boundary

4. OWNER(S) AND ADDRESS(ES)
Commonwealth of Massachusetts ☒Public ☐Private

5. SITE LOCATED BY
☒CRM Survey ☐Avocational Collector ☐Field School ☐Other (Specify)
Describe Sampling Strategy used to Locate Site:
Background literature, interviews with local individuals

6a. PERIOD(S) (Check all applicable boxes)
☐17th C. ☒18th C. ☒19th C. ☒20th C. ☐Unknown

6b. ESTIMATED OCCUPATION RANGE 1730-1790s

7. DATING METHOD
MAPS (See References, #21)
TITLE SEARCH ☒Yes ☐No
ADDITIONAL DOCUMENTS Clark's History of Norton, p.328
COMPARATIVE MATERIALS
OTHER interviews with locals, inc. Rob. Anderson

8a. SITE TYPE ☐Agrarian ☐Residential ☒Industrial ☐Commercial ☐Military ☐Unknown ☐Other (Specify)

8b. DESCRIBE began as sawmill in 1730, later became grist mill, shingle mill, cider mill, woodworking shop

9. DESCRIBE SIZE, HORIZONTAL AND VERTICAL BOUNDARIES Rt. 123 now passes over the entire length of the dam (100m); it's now bounded by power canal to Norton Cotton Co. to NW, to S by Clark House property. No subsurface testing done.

10. STRATIGRAPHY
Surface Indicators
☒Standing ruins
☒Surface finds
☐Markers
☐Cellar Hole
Stratigraphy
☐Stratified
☐NOT Stratified

11. SOIL fine grained sand & cobbles
USDA Soil Series
Contour Elevation 80'-100'
% Slope of Ground ☒0-5 ☐5-15 ☐15-25 ☐over
Acidity 1 —— 7 —— 14 (Acid) (Base)

12. TOPOGRAPHY ☒Flat ☐Gentle undulation ☐Rolling Hills ☐Mountains

13. WATER
NEAREST WATER SOURCE Canoe River
SIZE AND SPEED
DISTANCE FROM SITE less than 100'
SEASONAL AVAILABILIT year round

14. VEGETATION
PRESENT lush stand of poison ivy in vicinity of historic activity
PAST

15. SITE INTEGRITY ☐Undisturbed ☐Good ☒Fair ☐Destroyed
IF DISTURBED, DESCRIBE DISTURBANCE dam was partially disturbed by gradi & hot-topping of Rt. 123

16. SURROUNDING ENVIRONMENT
☐Open Land ☐Woodland ☐Eroded Soils ☒Residential ☐Scattered Buildings Visible from Site
☐Commercial ☐Industrial ☐Rural
☐Coastal ☐Isolated

17. ANY THREATS TO SITE ☒Yes ☐No
DESCRIBE POTENTIAL THREATS: dam will be partially destroyed by I-495 construction

18. ACCESSIBILITY TO PUBLIC
☐Free Access ☐Need Owner Permission ☒Restricted ☐No Access

RESEARCH STATUS

19. PREVIOUS WORK ☐ Surface Collected	BY WHOM/AFFILIATION	DATE
☐ "Pot hunted"	BY WHOM/AFFILIATION	DATE
☒ Tested	BY WHOM/AFFILIATION PAL, Brown University Dept. of Anthropology, Providence, R.I.	DATE 1977/1978
☐ Excavation	BY WHOM/AFFILIATION	DATE

20. PRESENT LOCATION OF MATERIALS (INCLUDE ADDRESSES)
Public Archaeology Lab., Brown University, Providence, R.I.

21. REFERENCES/REPORTS
Thorbahn, et al., Phase I and II reports on I-495 archaeology, PAL, Brown University

#7 (cont.) MAPS: 1795 Norton map by Cobb, 1830, 1851, 1855 (Walling, Bristol Co.),18
18

SIGNIFICANCE

22. RECOVERED DATA (identify IN DETAIL, including structures, related outbuildings, landscape features, etc.)

A. Documentary: mill foundation, dam, millyard, remnant of 3 acre mill pond remain. Built as water-powered sawmill in 1730 by Makepeace family; gristmill, shingle-making operation were added in 19th cent.

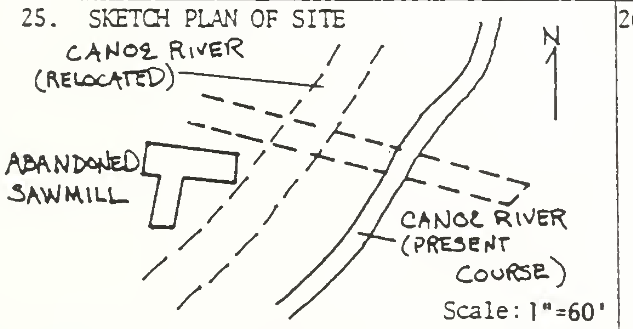
B. Archaeological:

23. ARCHAEOLOGICAL OR HISTORICAL SIGNIFICANCE
The establishment of the mill ca. 1730 spurred settlement of surrounding area. During the 1800s, the mill formed a stable nucleus for small rural/industrial community found in the Canoe River area.

SITE PLAN

24. ATTACH TO THIS FORM PORTION OF USGS QUAD WITH SITE AREA MARKED

25. SKETCH PLAN OF SITE



Scale: 1"=60'

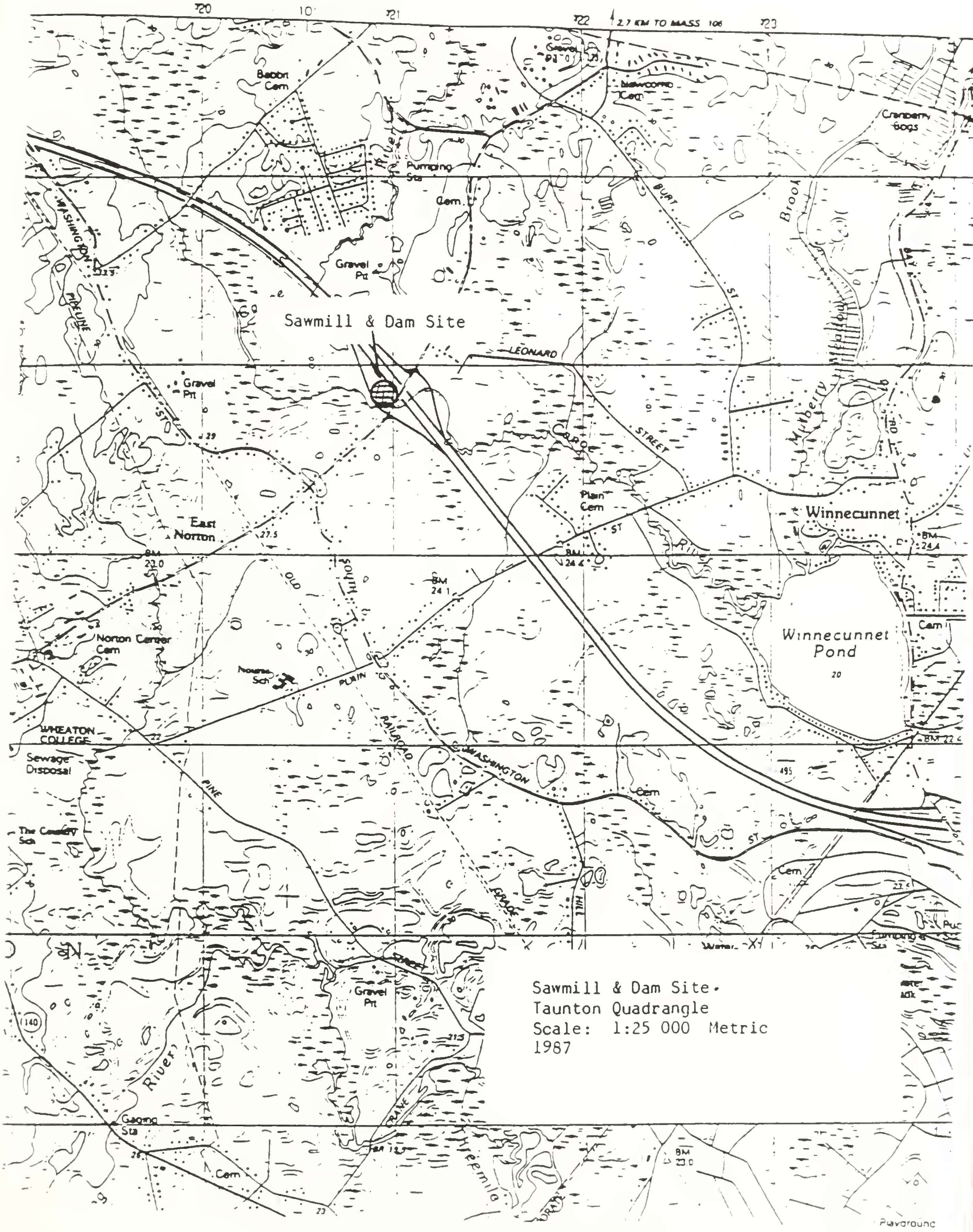
26. PHOTOS: Attach if available
Label each with: Date of photo, photographer, view shown, name of site

PORTED BY:	NAME John Norton	ADDRESS: 1375 Main Street, Norton, MA
	ORGANIZATION	DATE 25 July 1978

FOR OFFICE USE ONLY

IELD EVALUATION

OMMENTS



Sawmill & Dam Site

Sawmill & Dam Site.
Taunton Quadrangle
Scale: 1:25 000 Metric
1987

The Commonwealth of Massachusetts
William Francis Galvin, Secretary of the Commonwealth
Massachusetts Historical Commission

SURVEY TECHNICAL BULLETIN #1

JANUARY 1993
(reprinted January 1995)

The survey process prompts many questions of a substantive and technical nature. MHC's revised and expanded **Historic Properties Survey Manual: Guidelines for the Identification of Historic and Archaeological Resources in Massachusetts** (1992) provides guidance to organizations and individuals who conduct surveys and prepare MHC inventory forms. MHC survey staff has developed this bulletin in response to requests for additional guidance on technical issues related to the production of inventory forms and survey base maps. Other technical bulletins will be issued as the need arises. For more information, please contact MHC survey staff.

BLACK AND WHITE PHOTOGRAPHS

(See also pp. 23 and 26 of the **Survey Manual** as well as inventory form instructions.)

Label the back of each photograph with the city/town name and property address. If the photograph shows resources within an inventoried area, include the area name on the back. Labeled photographs ensure that if a photograph should become separated from its form, MHC staff will be able to return the photograph to the form.

One or two photographs may be stapled to the upper left side of the form. Photographs should be placed under the MHC address lines, covering the roll/negative space. Attach any additional photographs to continuation sheets. Do not use tape to attach photographs. In addition to permanently marking the photograph, the glue in tape disintegrates over time, causing the photographs to separate from the inventory forms.

Photographs attached to inventory form continuation sheets should be placed at least one inch (1") from the bottom of the page. In the filing system for the statewide inventory, inventory forms are bound into file folders at the bottom. The one-inch bottom margin ensures that photographs are not damaged during the binding process.

Historic photographs are welcome, but are not acceptable substitutes for a current black and white photo of the resource. Note that any photograph submitted with an inventory form should reflect the condition of the resource at the time it was surveyed.

INVENTORY FORM SKETCH MAPS

(See also pp. 26-31 of the ***Survey Manual*** as well as inventory form instructions.)

For maximum readability, and to allow for clear reproductions, sketch maps on inventory forms should be executed in black pen. Ball-point and similar pens are a better choice than felt-tip pens, since the ink from felt-tips tends to bleed into the paper. Laundry markers and "writes on anything"-type felt-tip markers in particular have proved to bleed into the paper over the long term. Information conveyed in pencil, colored pencil, and colored marker does not reproduce in photocopies. Instead, cross-hatching, dotted lines, and similar methods may be used to provide contrast in black and white sketch maps.

If your sketch map distinguishes historic from contemporary resources, or if you use any graphic notations not illustrated in the ***Survey Manual***, provide a sketch map key. A key enables those who are not familiar with the inventoried resource to understand fully the information conveyed on the sketch map.

A sketch map for an area, streetscape, burial ground, or park/landscape should clearly indicate the boundaries of the inventoried resource in relation to existing natural or man-made features. To the extent possible, any individual resources within the boundaries which are specifically discussed in the form narrative also should be indicated in the sketch map.

Sketch maps and associated keys or other notes should appear at least one inch (1") from the bottom of the inventory form. In the filing system for the statewide inventory, inventory forms are bound into file folders at the bottom. The one-inch bottom margin ensures that information conveyed by sketch maps is not lost as a result of the binding process.

USGS QUAD NOTATIONS AT TOP OF INVENTORY FORMS

(See also inventory form instructions in ***Survey Manual.***)

The U. S. Geological Survey has begun issuing 7.5 x 15-minute series topographic quadrangle maps that cover twice the area of the earlier (7.5-minute series) maps. The change in map coverage has resulted in a change in some quad names (*e.g.*, a property that was once in the Gloucester quad on the smaller maps may now be in the Rockport quad on the larger, double-quad maps). In an effort to maintain consistency of inventory information, the old 7.5-minute series maps should continue to be used to determine quad names for inventory purposes.

ASSEMBLING MHC INVENTORY FORMS

In the filing system for the statewide inventory, inventory forms are bound into file folders at the bottom. Consequently, original double-sided MHC inventory forms are printed "head to toe," *i.e.*, the backs of the forms are printed upside down. Inventory forms submitted to MHC for incorporation into the statewide inventory should conform to this format. Exceptions are inventory form continuation sheets and National Register criteria statement forms, which are single-sided. (**Note:** In the sample forms presented in the ***Survey Manual***, the back pages were turned right side up to improve readability.)

Attach additional sheets at the bottom of the inventory form. One or two staples at the bottom center, beneath the "*Follow MHC instructions...*" line, is sufficient.

Note that during the binding process, holes are punched at the bottom of each inventory form. To ensure that valuable data is not lost during binding, be sure to place all photographs, sketch maps, and written information at least one inch (1") from the bottom of inventory forms and continuation sheets.

ORGANIZING INVENTORY FORMS AND ASSIGNING LETTERS/ NUMBERS

(See also p. 31 of the ***Survey Manual*** as well as inventory form instructions.)

To date, inventory information for over 200 of the 351 cities and towns in the Commonwealth has been entered into MHC's computer database, MACRIS (Massachusetts Cultural Resource Information System). Occasionally, a community's inventory forms are renumbered during the computerization process (with both old and new numbers being entered into the database). MHC inventory letters and numbers assigned to newly completed forms always begin where previous numbering ended. Note that MHC does not "infill" any gaps, *i.e.*, go

back and assign to new forms any letters or numbers that were skipped previously. To determine whether a city/town's inventory has been computerized, and to confirm where lettering or numbering of new inventory forms should begin, contact MHC survey and MACRIS staffs for assistance before assigning inventory letters and numbers.

Local historical commissions submitting a small number of inventory forms on a sporadic but ongoing basis need not assign inventory letters/numbers, unless a local system of pre-assigned numbering is in effect. **Note:** Only numbers that conform to the MHC inventory numbering system should be placed in the "Form Number" box at the top of the form.

Preservation consultants and other cultural resource professionals submitting a large number of inventory forms are expected to assign inventory letters/numbers and map the inventoried resources on a large-scale base map (see below). MHC staff has developed a three-step strategy for assigning inventory letters/numbers which minimizes any gaps in a community's inventory numbering system and facilitates MACRIS data entry.

Step One: Group any area forms and streetscape forms together. (**Note:** Streetscape forms should not be filed with building forms. See *Survey Manual*, pp. 103-104 for more information about streetscape forms.) Letter area and streetscape forms consecutively.

Step Two: Number all individually inventoried resources consecutively. Remember that burial grounds/cemeteries are assigned numbers in the 800 range and structures, objects, and parks/landscapes are assigned numbers in the 900 range. Be sure to include these assigned inventory numbers on any data sheets attached to related area or streetscape forms.

Step Three: Number any previously unnumbered resources that are listed on any data sheets attached to area and streetscape forms. Go through the data sheets of areas and streetscapes in order (Area A, Area B, Area C, etc.). Assign consecutive numbers to any resources that were not surveyed individually and therefore do not already have an inventory number. Remember to follow the guidelines for numbering burial grounds/cemeteries, structures, objects, and parks/landscapes.

To the extent possible within the above guidelines, assign MHC numbers to correspond roughly to the geographic proximity of inventoried resources. While this is helpful, it is often not feasible when data sheets are produced during the survey project.

REVISING OR UPDATING INVENTORY FORMS

MHC staff welcomes revisions or updates for previously submitted inventory forms. Revisions are redrafts of existing inventory forms. Updates are amendments to existing forms which are made on inventory form continuation sheets. In both cases, new submittals to MHC are attached to the existing form and filed under the existing inventory number. Note that the statewide inventory files are a public archive and part of the public record; as such, outdated inventory forms ordinarily are not discarded. Contact MHC survey staff for assistance in determining whether an existing form should be revised or updated.

LARGE-SCALE BASE MAPS

(See also pp. 165-166 of the ***Survey Manual*** as well as the "Sketch Maps" section above.)

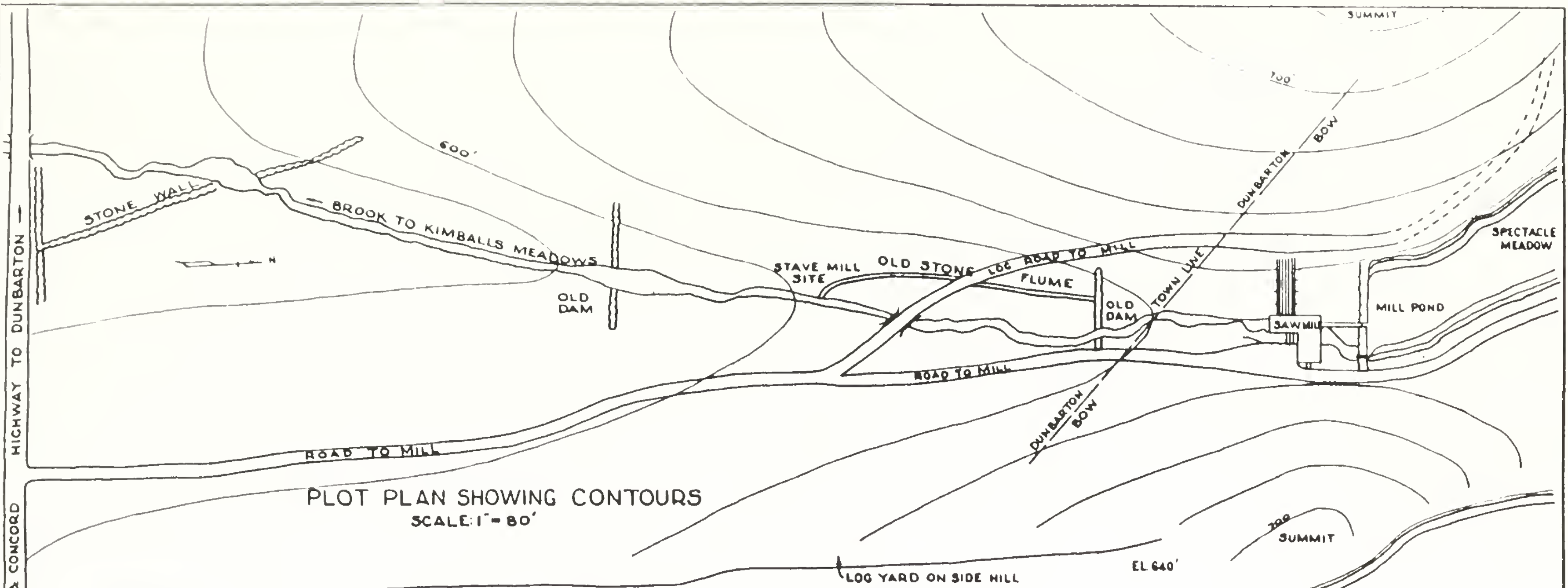
Even on a large-scale base map of the community, it is sometimes not possible to indicate clearly each inventoried resource within a collection of multiple resources such as an area, streetscape, burial ground, or park/landscape. If this is the case, on the base map draw the boundaries of the area, streetscape, burial ground, or park/landscape and label with the appropriate inventory letter or number. Note next to the boundaries or in the base map key that a more detailed map appears on the inventory form. For a collection of multiple resources, a detailed map should always be included as part of the corresponding inventory form.

Survey Technical Bulletin #1 has been financed in part with federal funds from the National Park Service, U. S. Department of the Interior. However, the contents and opinions do not necessarily reflect the view or policies of the Department of the Interior.

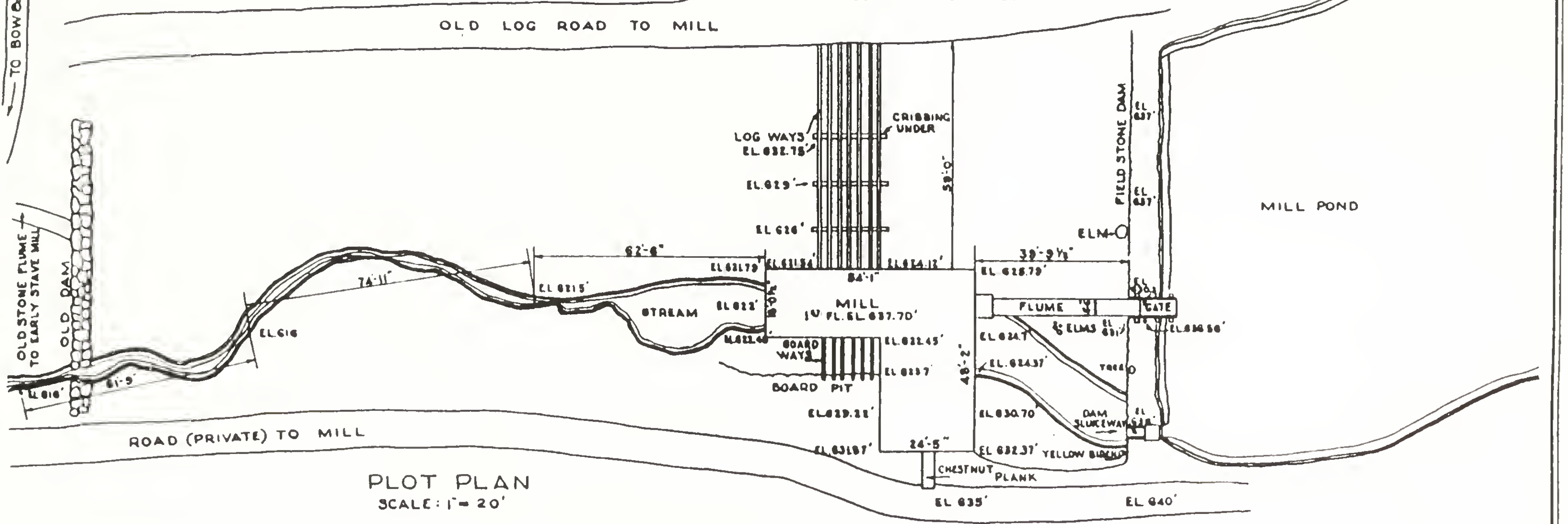
This program receives federal funds from the National Park Service. The U. S. Department of the Interior prohibits discrimination on the basis of race, color, national origin, age, gender, or handicap in its federally assisted programs. If you believe you have been discriminated against in any program, activity, or facility as described above, or if you desire further information, please write to:

Office for Equal Opportunity
U. S. Department of the Interior
1849 C Street NW, Room 1324
Washington, D. C. 20240

Appendix B: HABS Architectural Plans for Bow NH Mill



PLOT PLAN SHOWING CONTOURS
SCALE: 1" = 80'



PLOT PLAN
SCALE: 1" = 20'

E B PHILBRICK DEL.
WORKS PROGRESS ADMINISTRATION
OFFICIAL PROJECT NO 265-6907

PLOT PLANS

U.S. DEPARTMENT OF THE INTERIOR
OFFICE OF NATIONAL PARKS BUILDINGS AND RESERVATIONS
BRANCH OF PLANS AND DESIGN

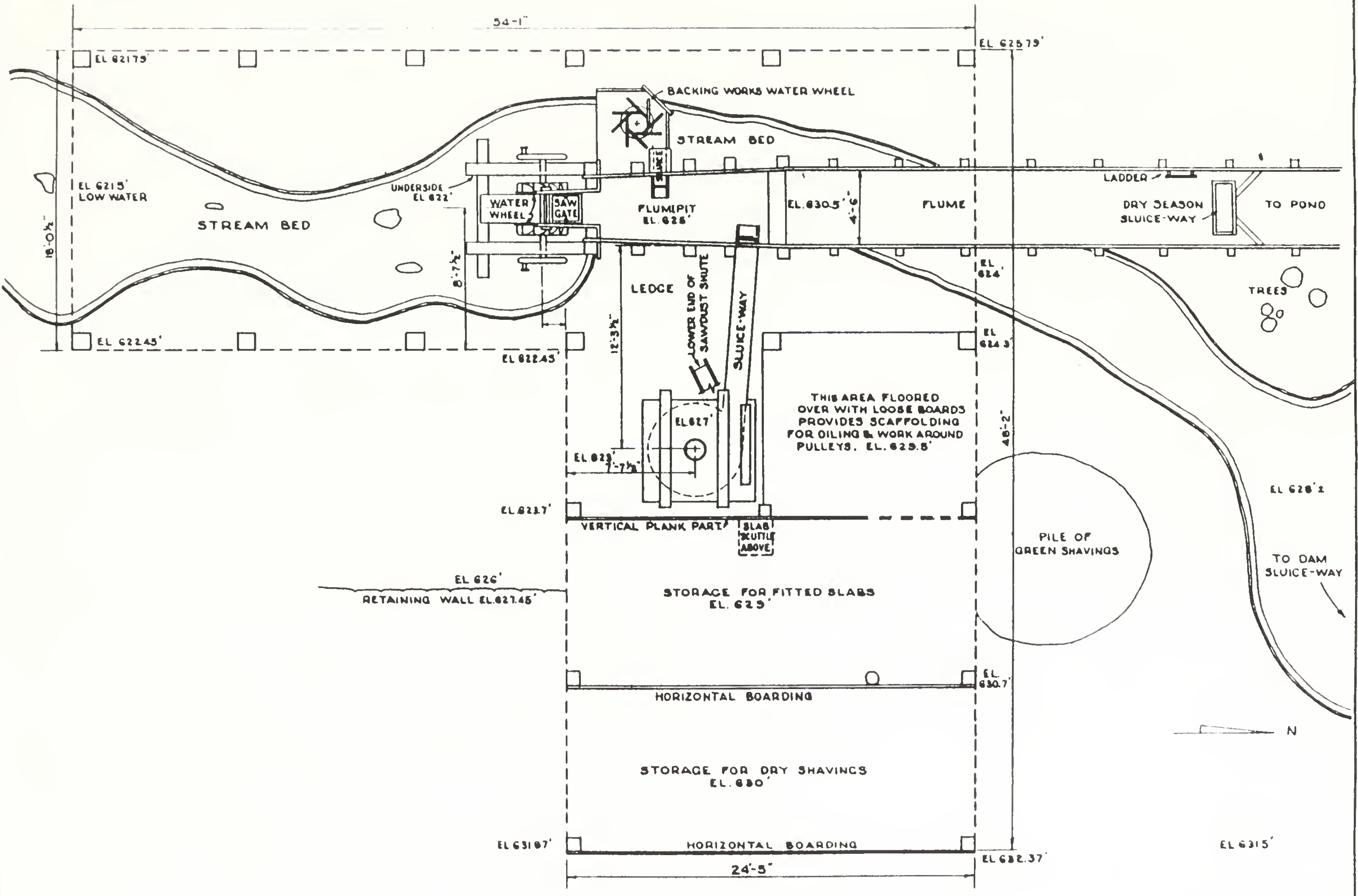
NAME OF STRUCTURE
NICHOLS SAW MILL
BOW MILLS VICINITY
MERRIMACK COUNTY
NEW HAMPSHIRE

SURVEY NO
NH-31

HISTORIC AMERICAN
BUILDINGS SURVEY
SHEET 1 OF 20 SHEETS

INDEX NO

DUE TO INSUFFICIENT INFORMATION AT THE
TIME OF EDITING THIS MATERIAL MAY NOT



GROUND PLAN

SCALE: ¼"=1'-0"

E B PHILBRICK, DEL.
WORKS PROGRESS ADMINISTRATION
OFFICIAL PROJECT NO 265-6907

U.S. DEPARTMENT OF THE INTERIOR
OFFICE OF NATIONAL PARKS, BUILDINGS AND RESERVATIONS
BRANCH OF PLANS AND DESIGN

NAME OF STRUCTURE
NICHOLS SAW MILL
BOW MILLS VICINITY
MERRIMACK COUNTY
NEW HAMPSHIRE

SURVEY NO.
NH-31

HISTORIC AMERICAN
BUILDINGS SURVEY
SHEET 2 OF 20 SHEETS

INDEX NO

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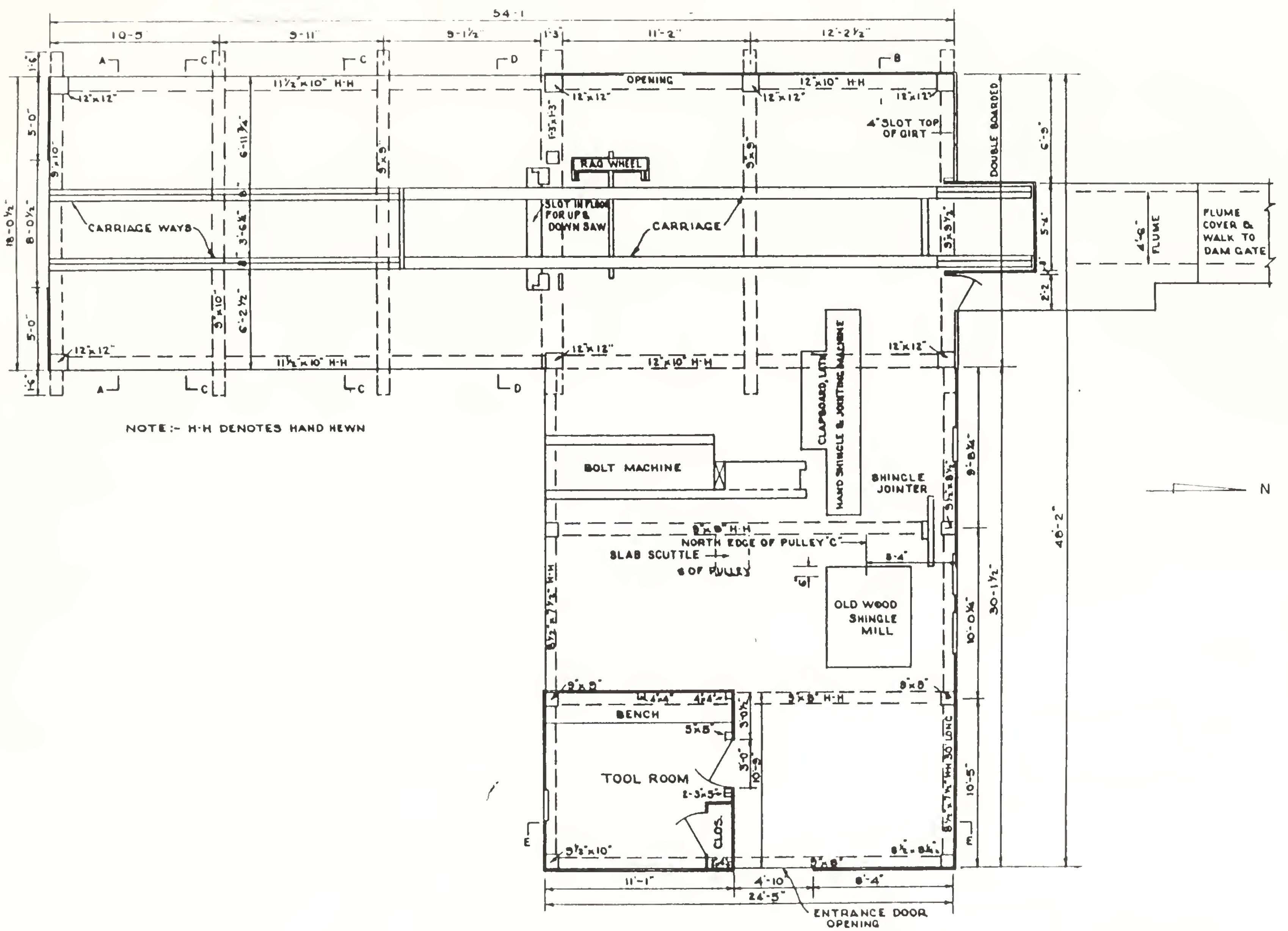

MILL FLOOR PLAN

SCALE 1/4" = 1'-0"

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OFFICIAL PROJECT NO. 265-6907

U.S. DEPARTMENT OF THE INTERIOR
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BRANCH OF PLANS AND DESIGN

NAME OF STRUCTURE
NICHOLS SAW MILL
BOW MILLS VICINITY
MERRIMACK COUNTY
NEW HAMPSHIRE

SURVEY NO.
NH-31

HISTORIC AMERICAN
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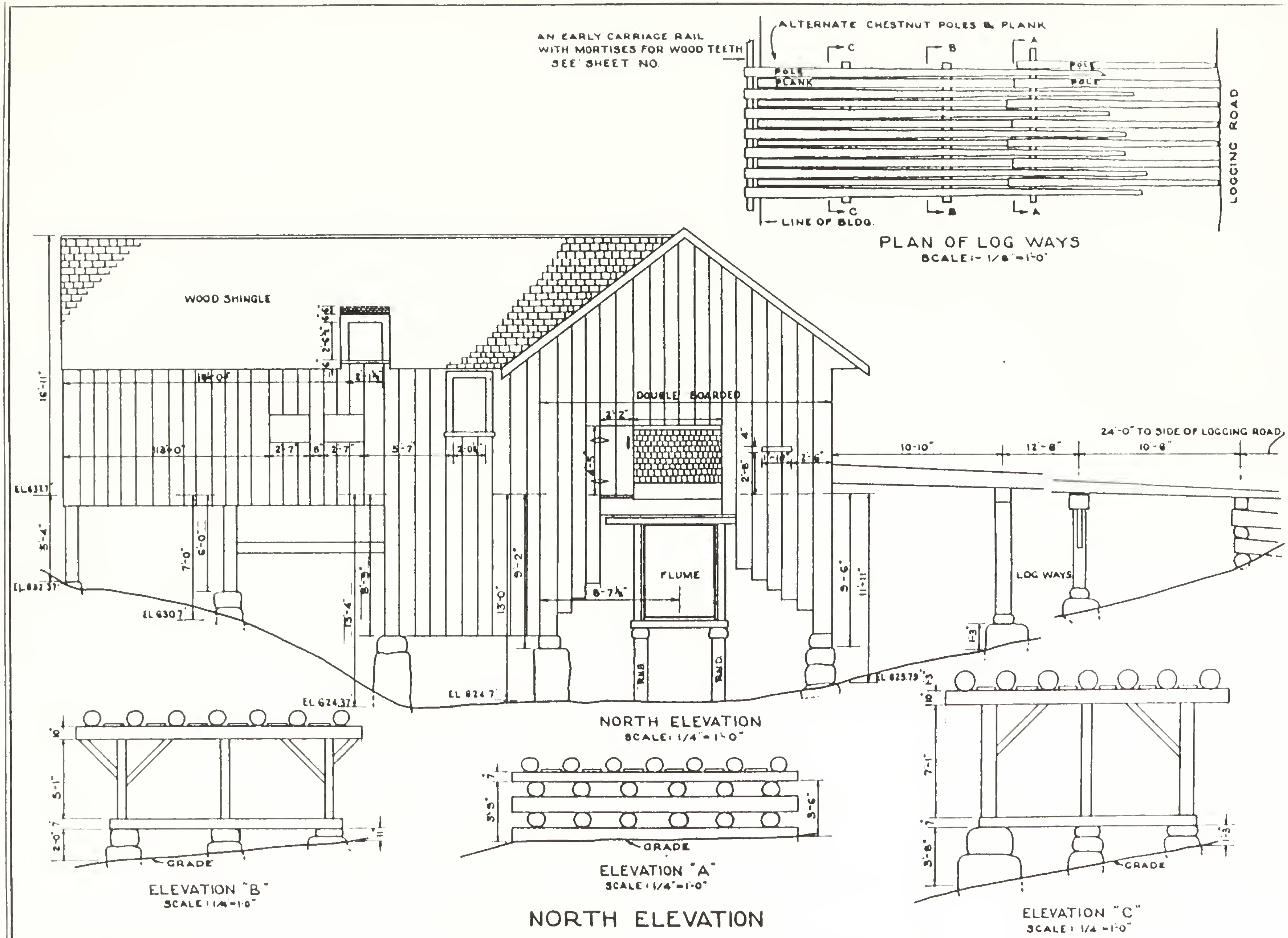

NORTH ELEVATION

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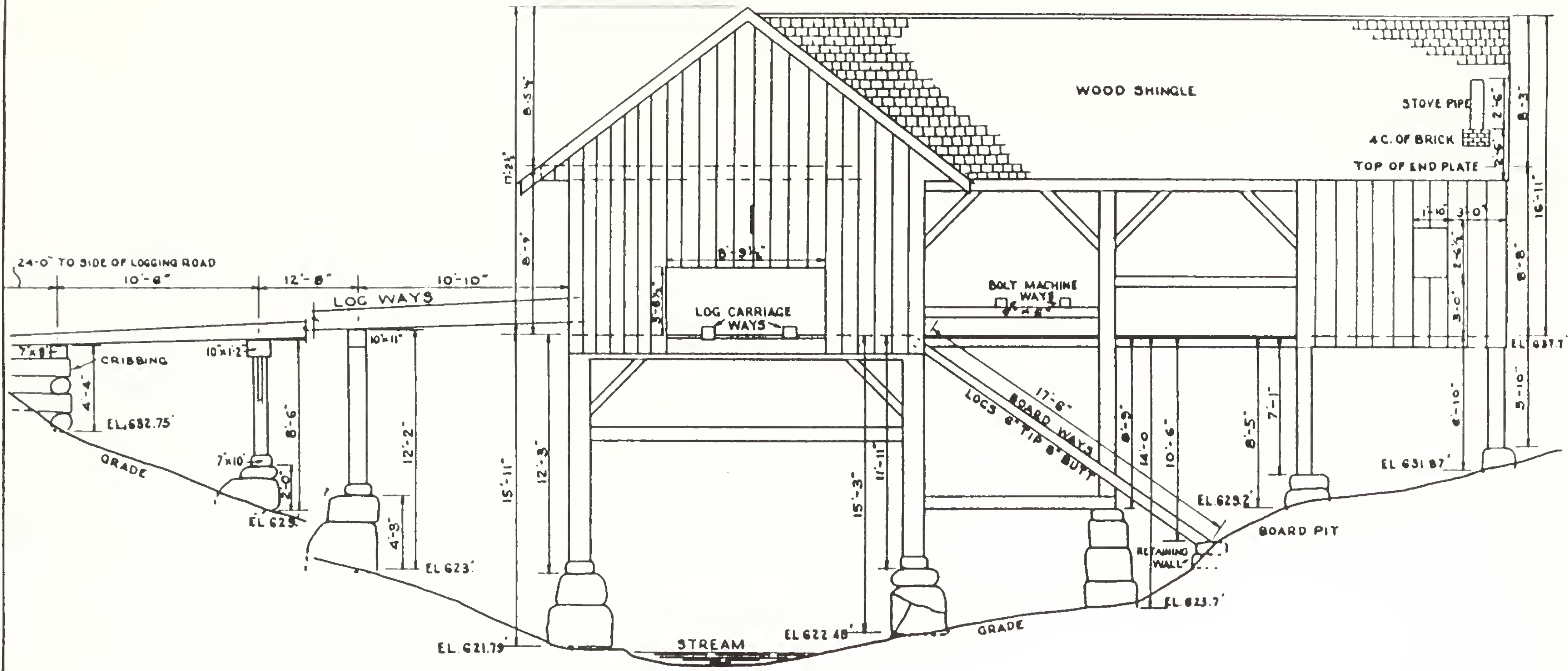

SOUTH ELEVATION

SCALE 1/4" = 1'-0"

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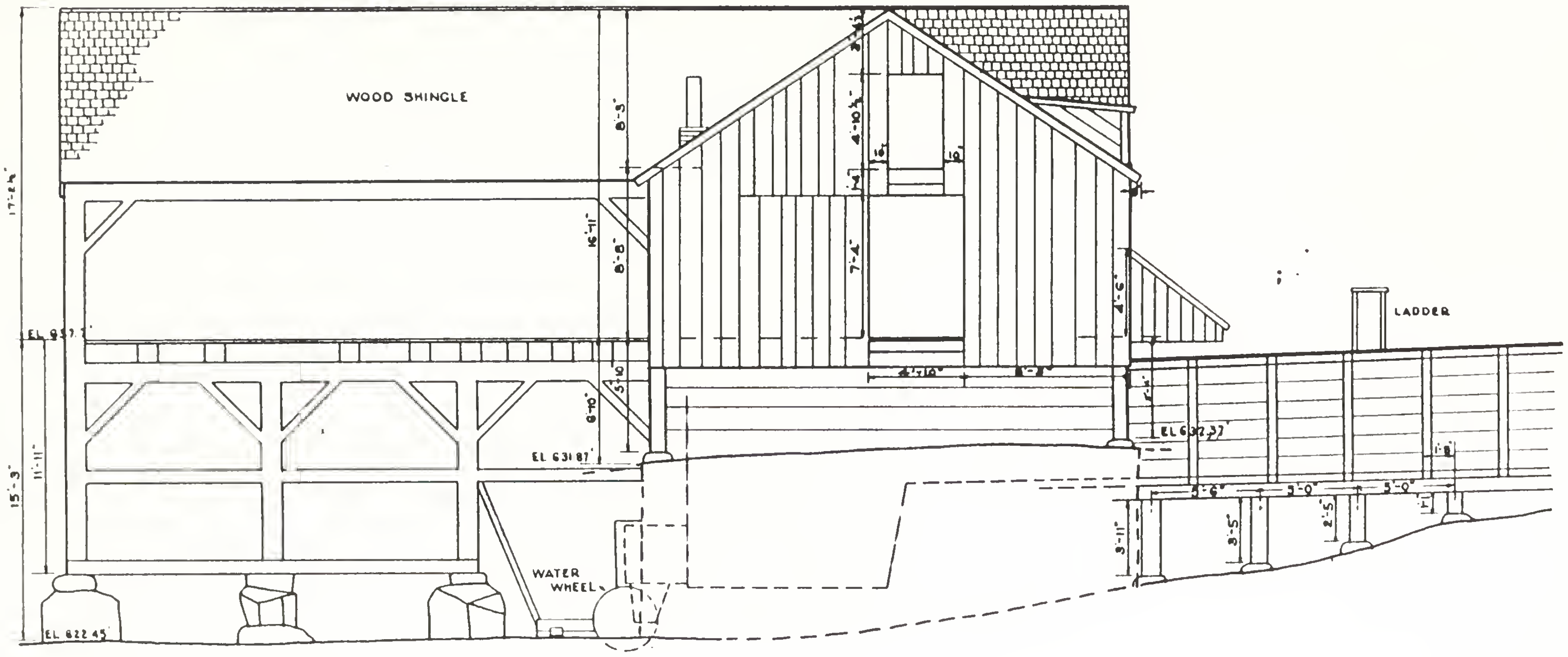

EAST ELEVATION

SCALE:- 1/4"=1'-0"

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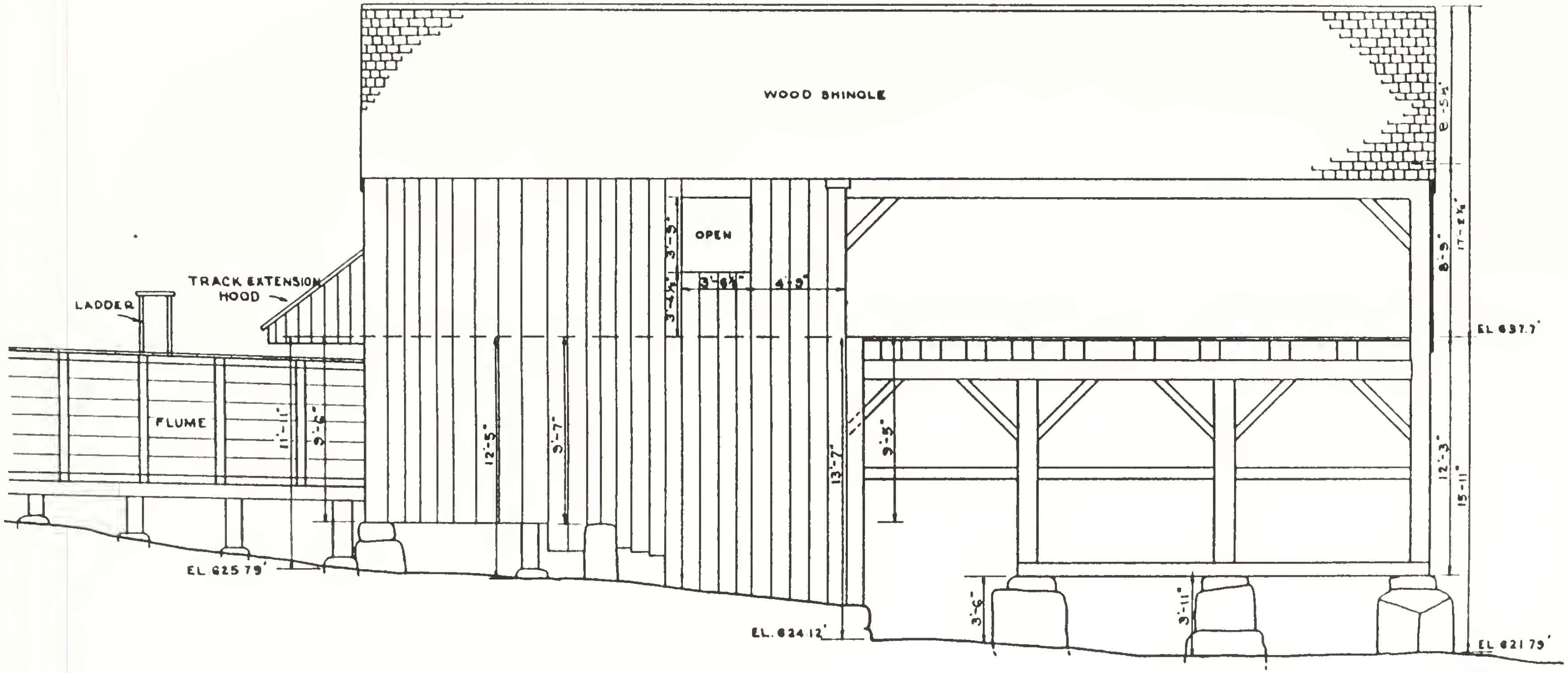

WEST ELEVATION

SCALE-1/4" = 1'-0"

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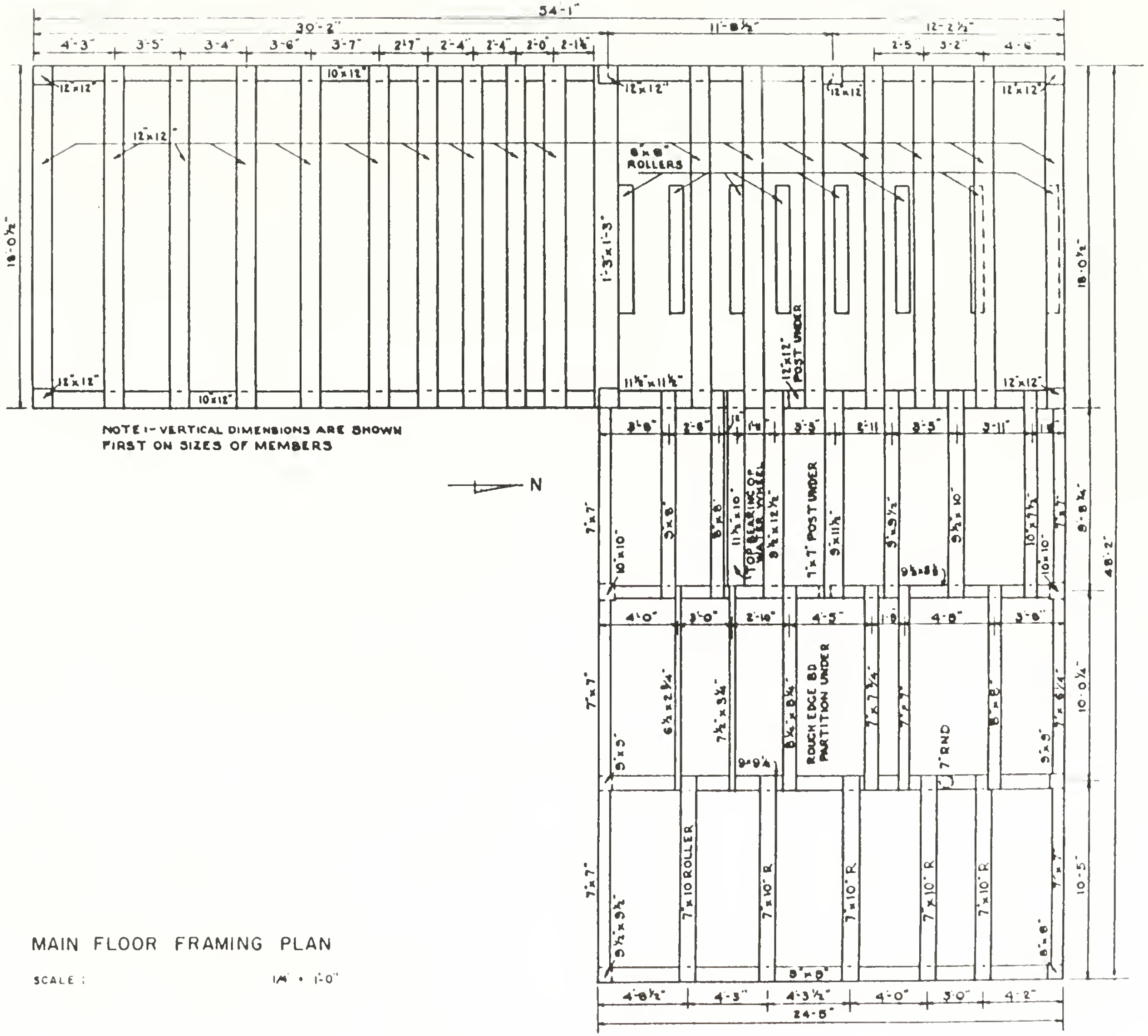

NOTE I - VERTICAL DIMENSIONS ARE SHOWN FIRST ON SIZES OF MEMBERS

MAIN FLOOR FRAMING PLAN

SCALE : 1/4" = 1'-0"

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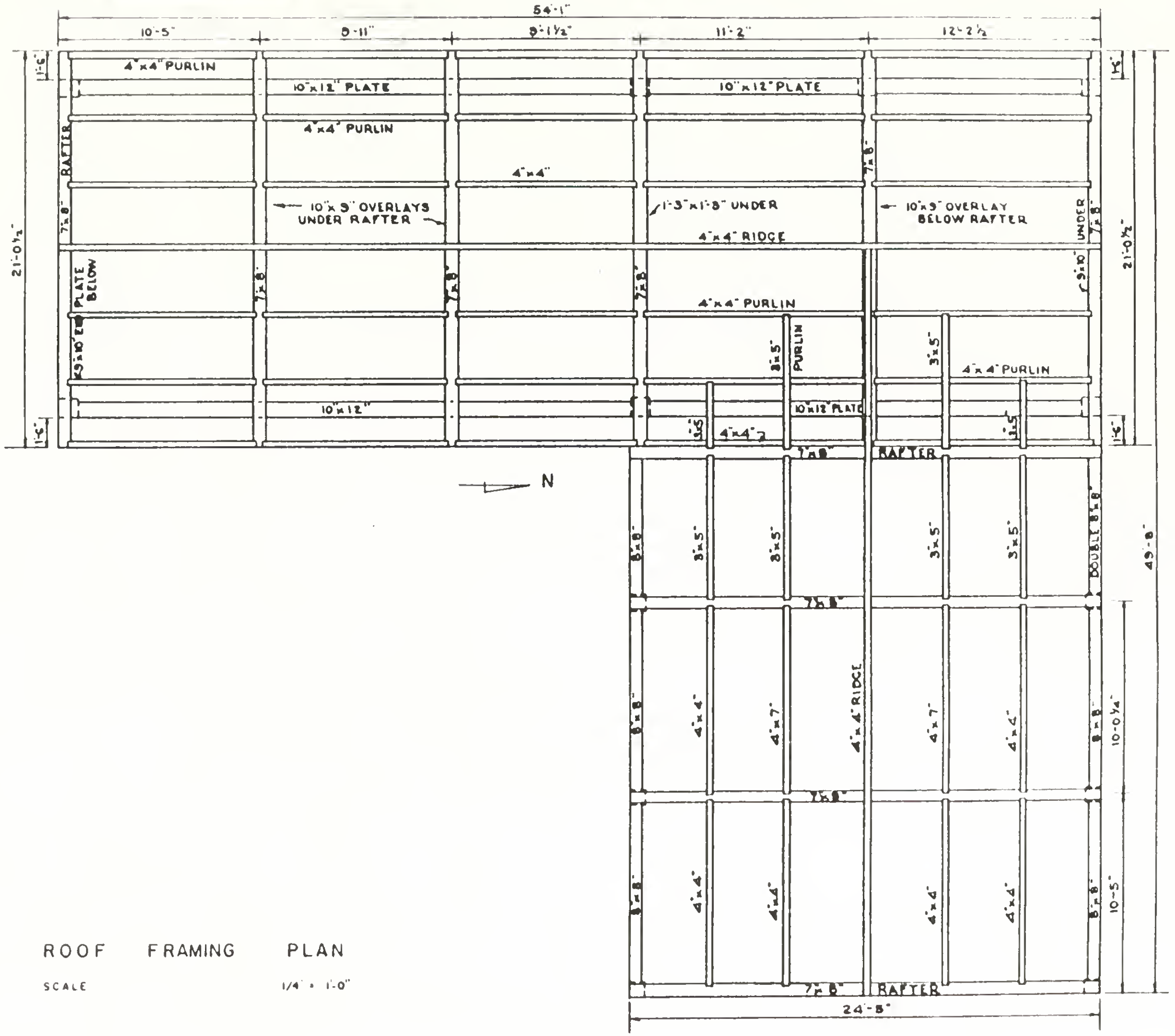

ROOF FRAMING PLAN

SCALE 1/4" = 1'-0"

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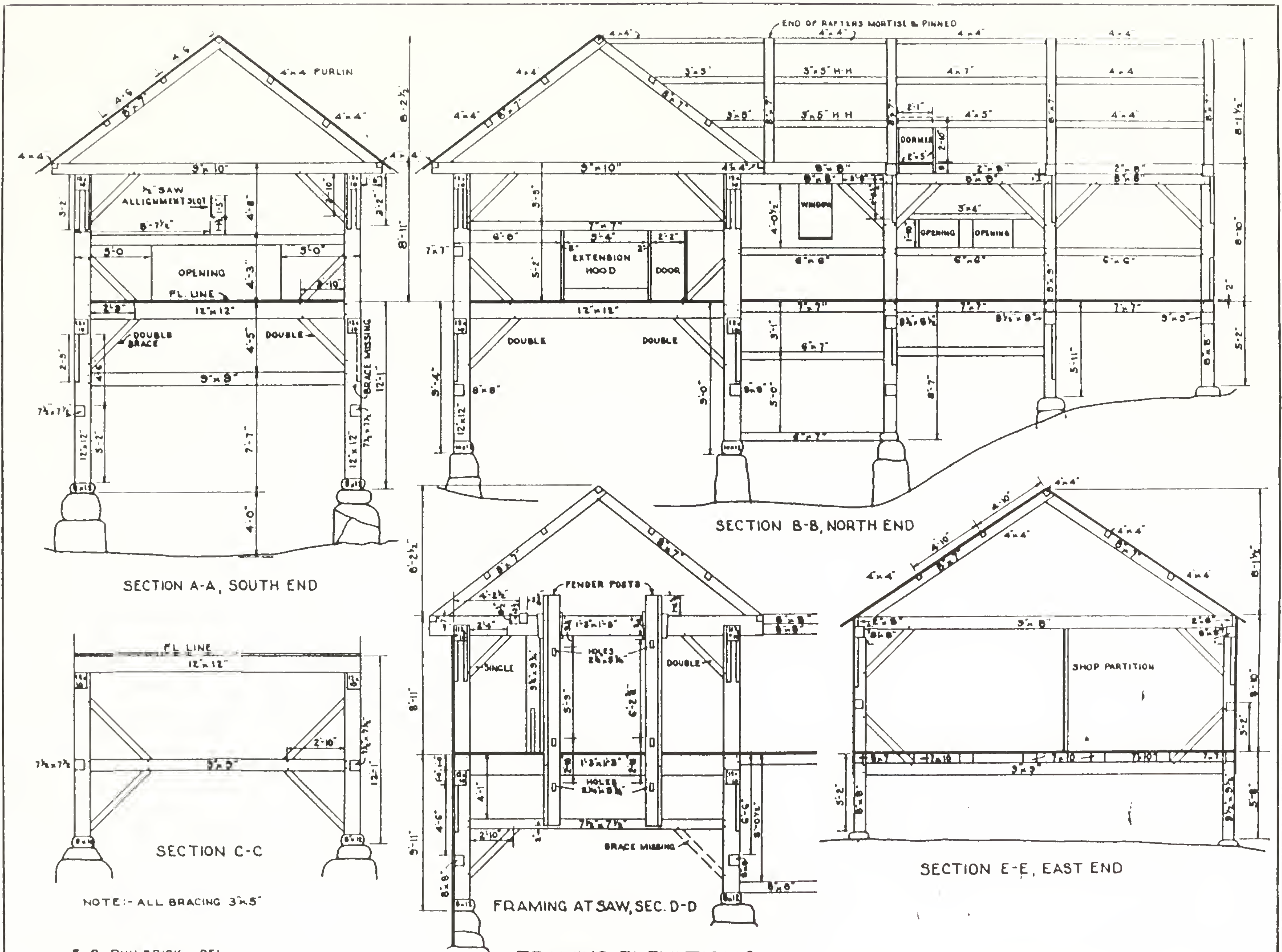

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FRAMING ELEVATIONS

SCALE:- 1/4" = 1'-0"

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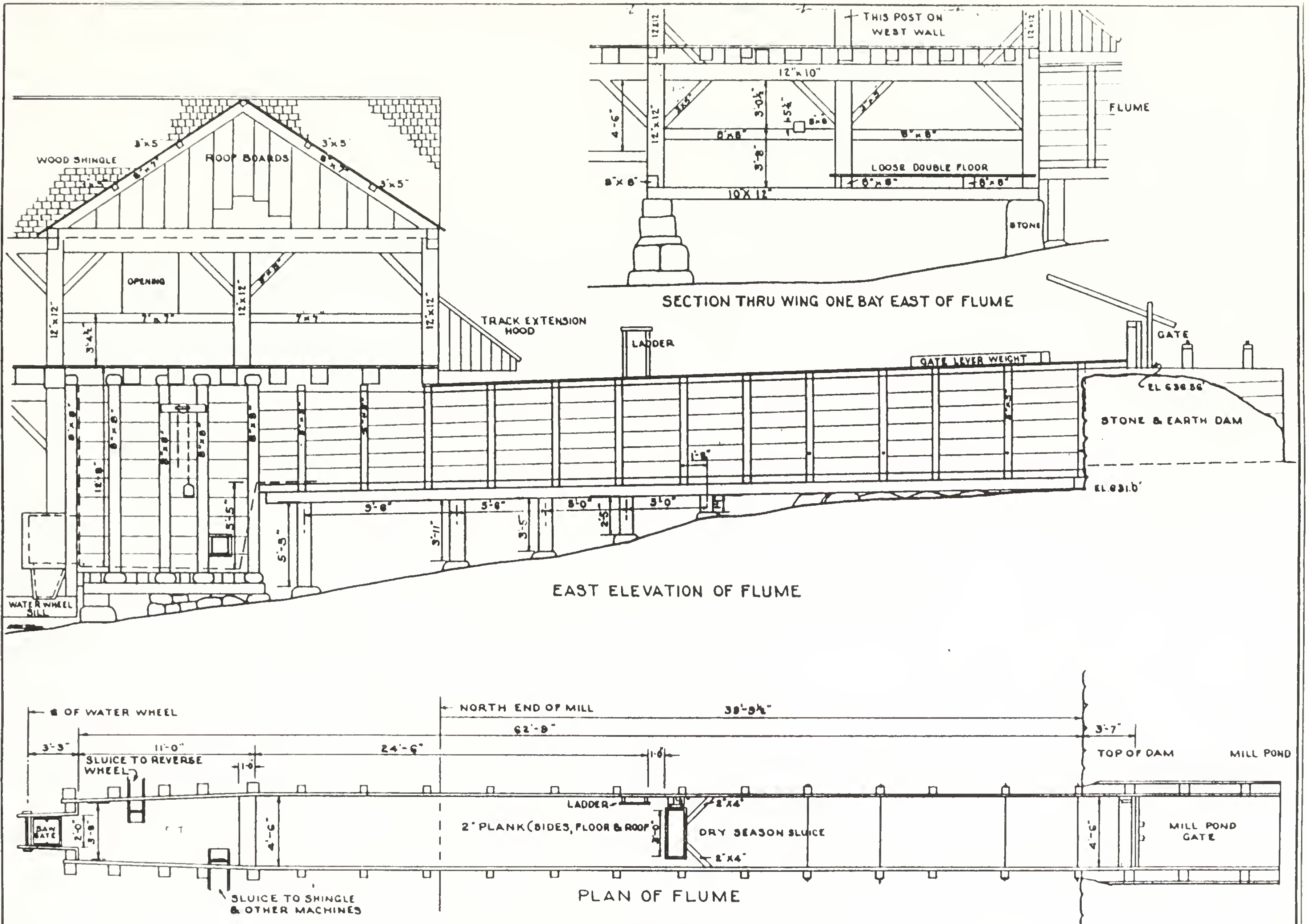

PLAN & ELEVATION OF FLUME WITH SECTION THRU WING

SCALE: 1/4"=1'-0"

E. B. PHILBRICK, DEL.
WORKS PROGRESS ADMINISTRATION
OFFICIAL PROJECT NO 265-6607

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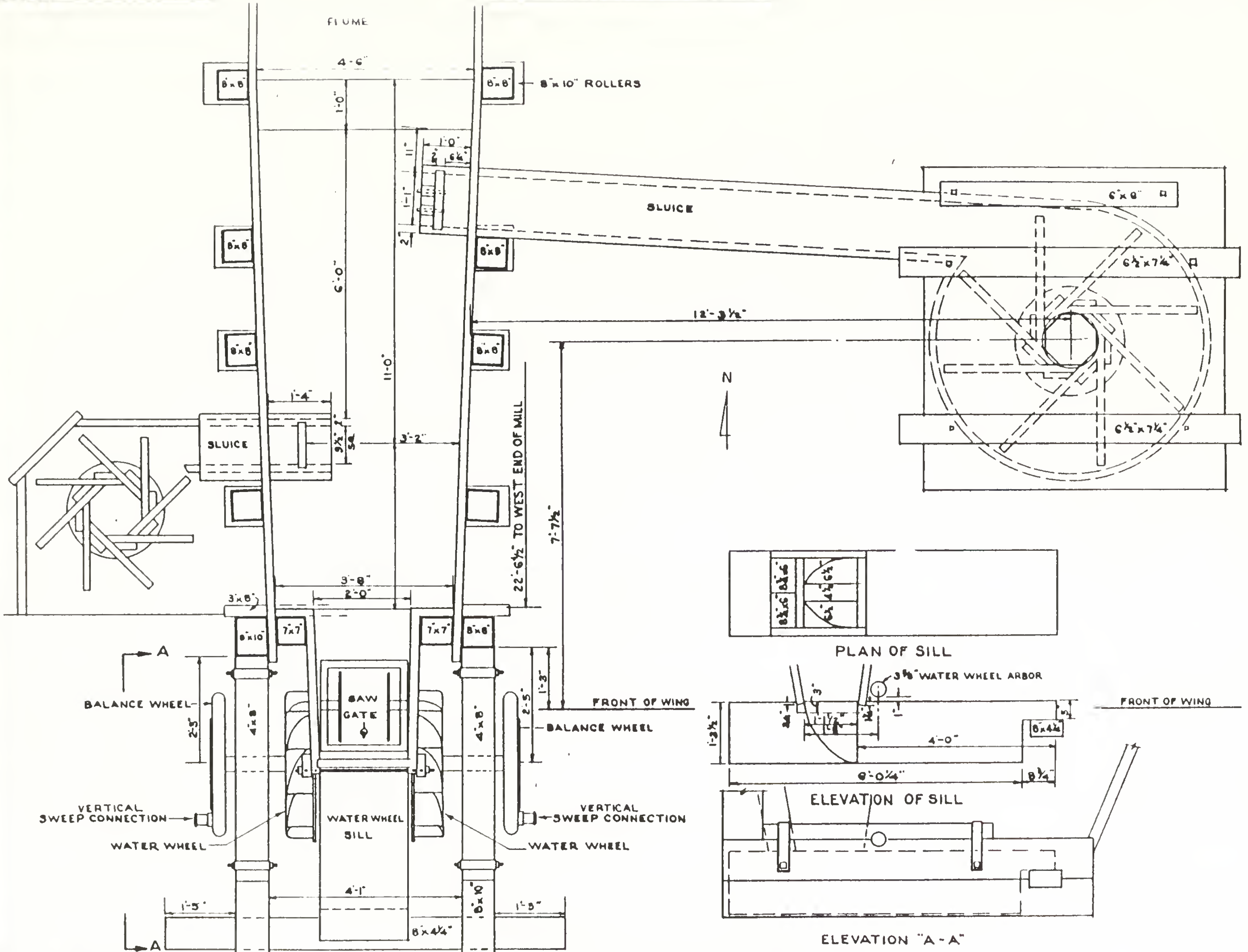

PLAN-FLUME & WATER WHEELS

SCALE:- 3/4"=1'-0"

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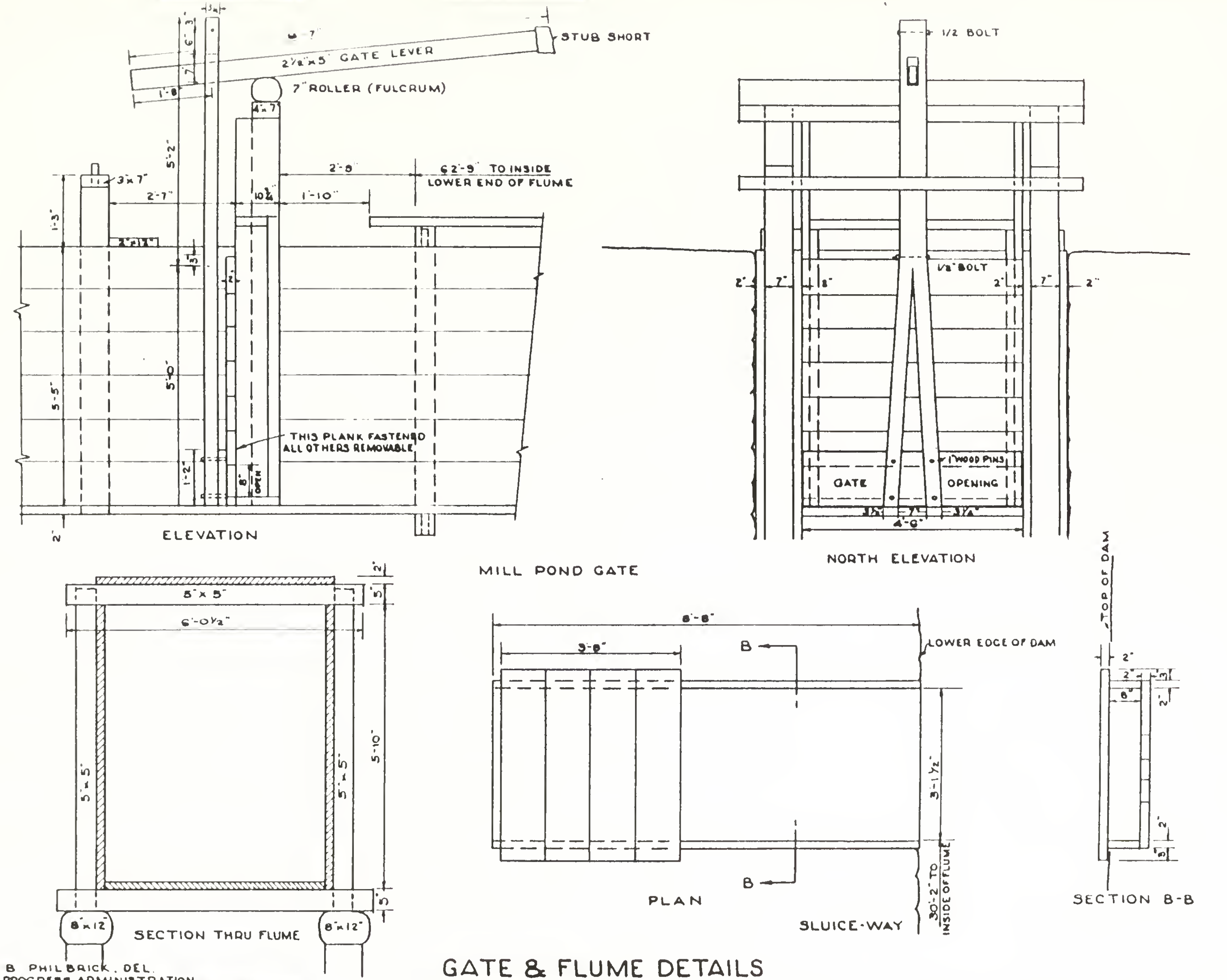

GATE & FLUME DETAILS

SCALE :- 3/4" = 1'-0"

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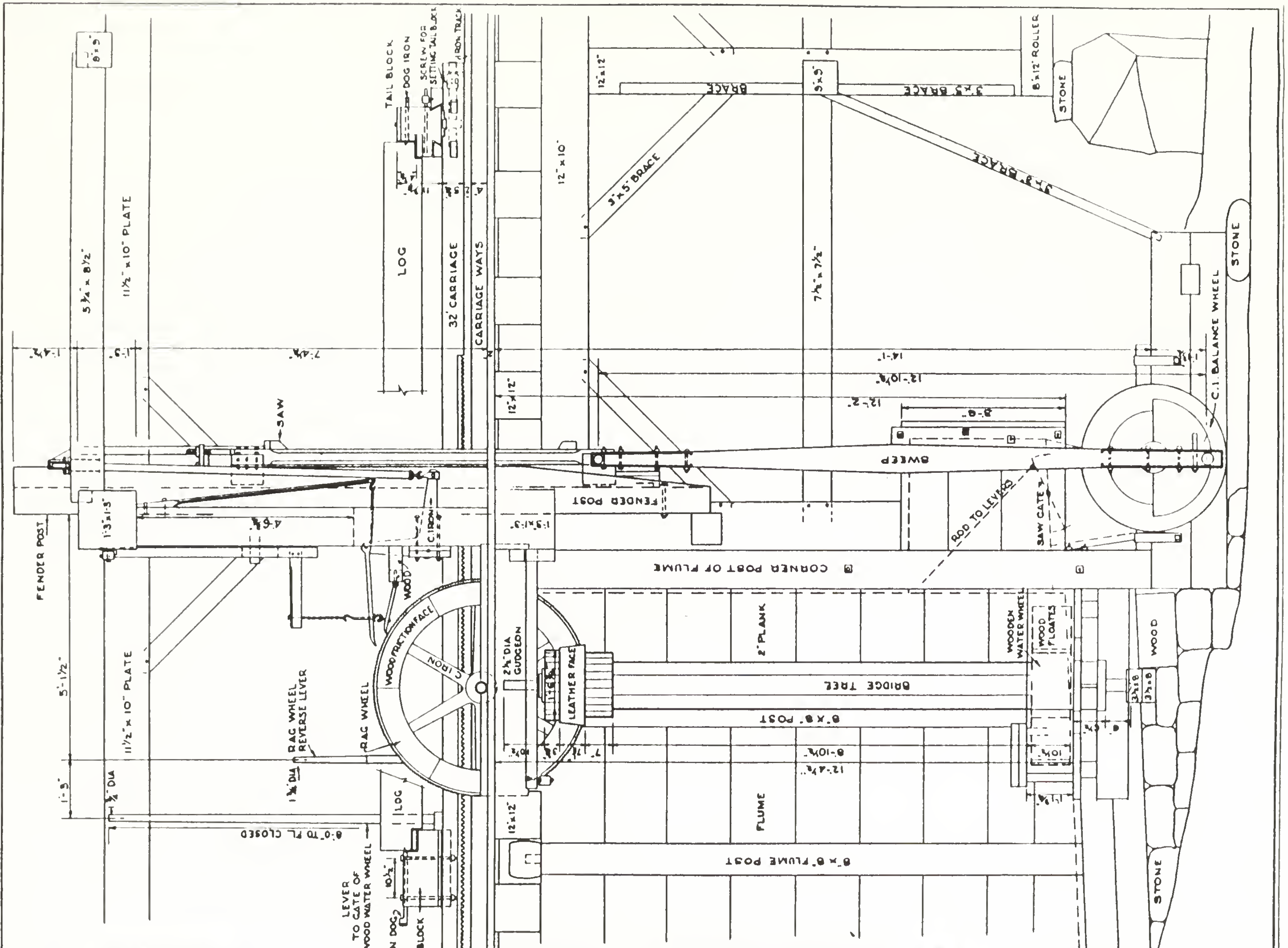

WEST ELEV. UP & DOWN SAW MACHINERY
SCALE ¾"=1'-0"

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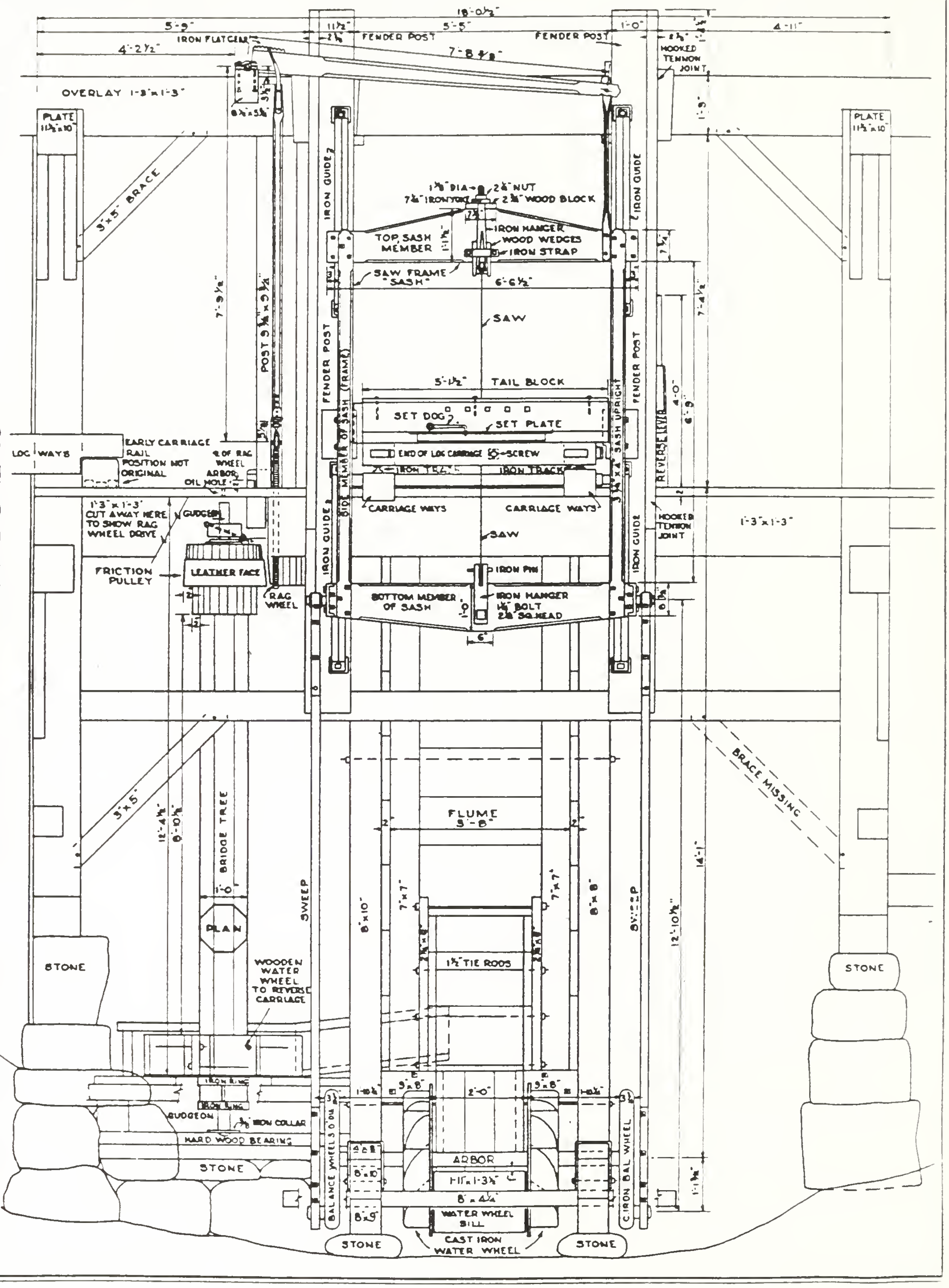

SOUTH ELEV. UP & DOWN SAW MACHINERY

SCALE ¾" = 1'-0"

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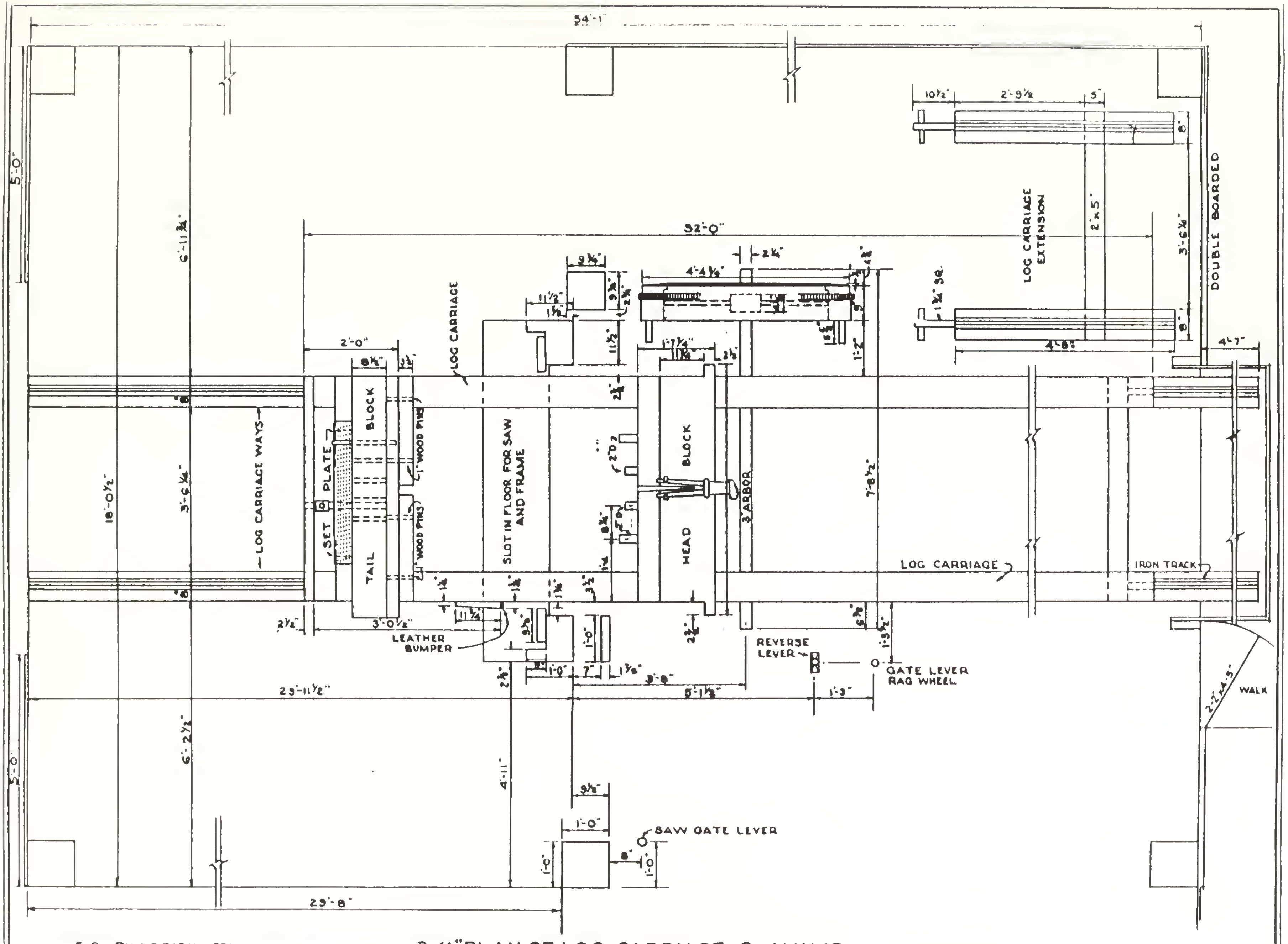
DECIMETERS



3/4" PLAN OF LOG CARRIAGE & WAYS

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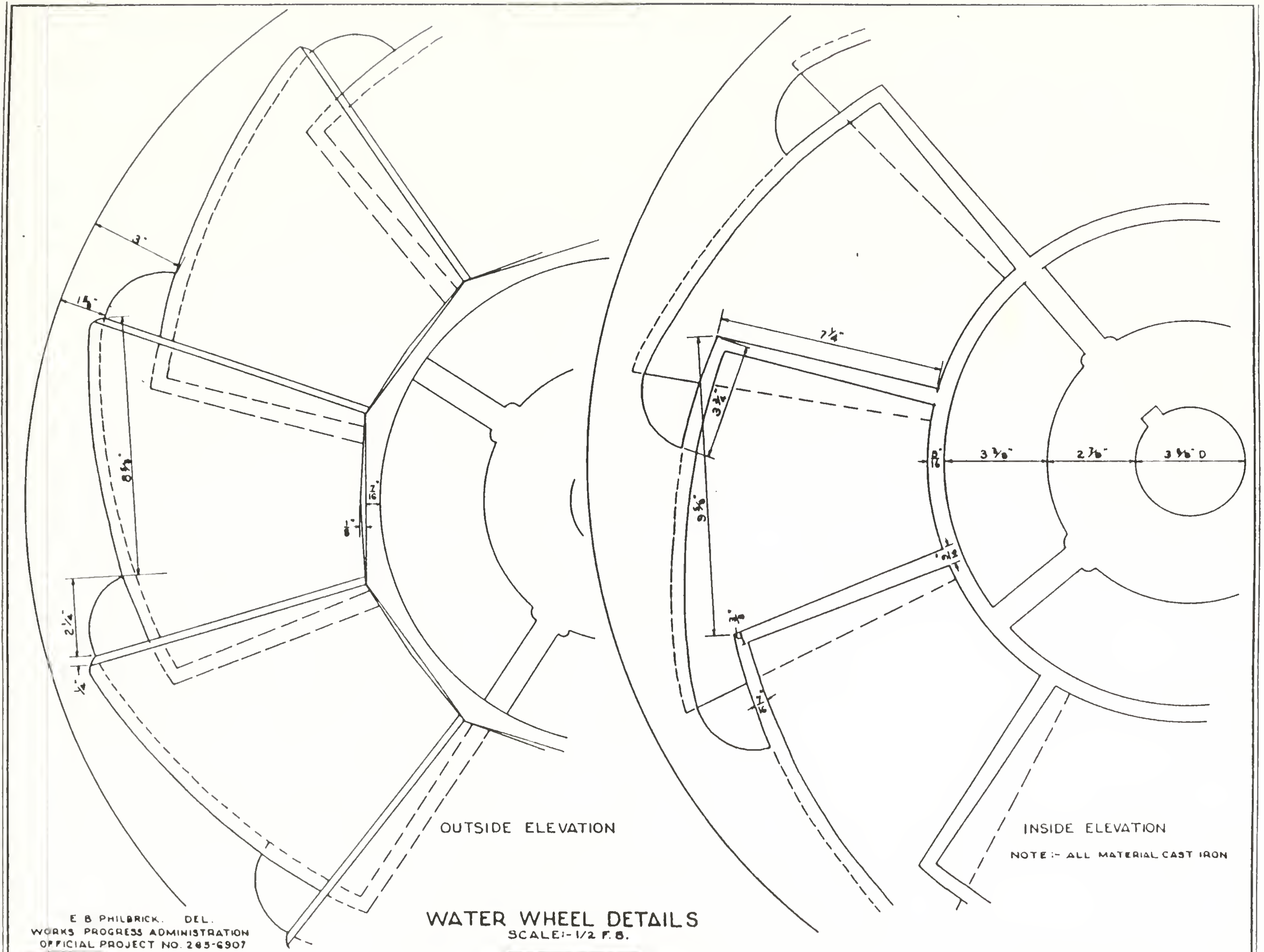

OUTSIDE ELEVATION

INSIDE ELEVATION

NOTE:- ALL MATERIAL CAST IRON

WATER WHEEL DETAILS

SCALE:- 1/2 F.S.

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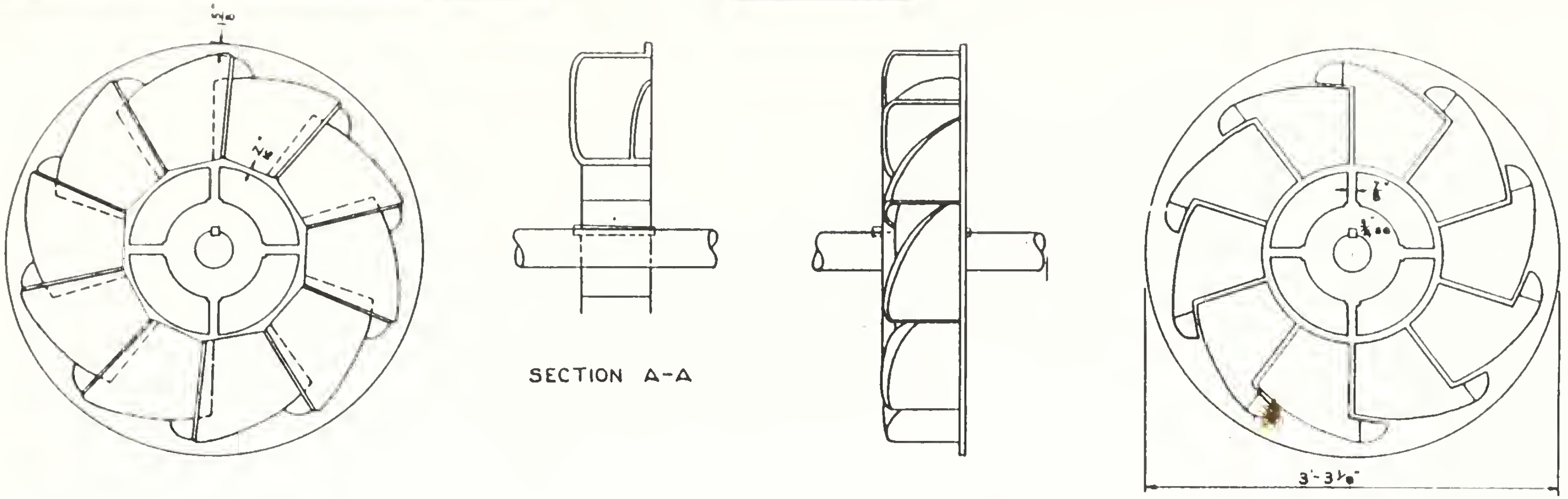


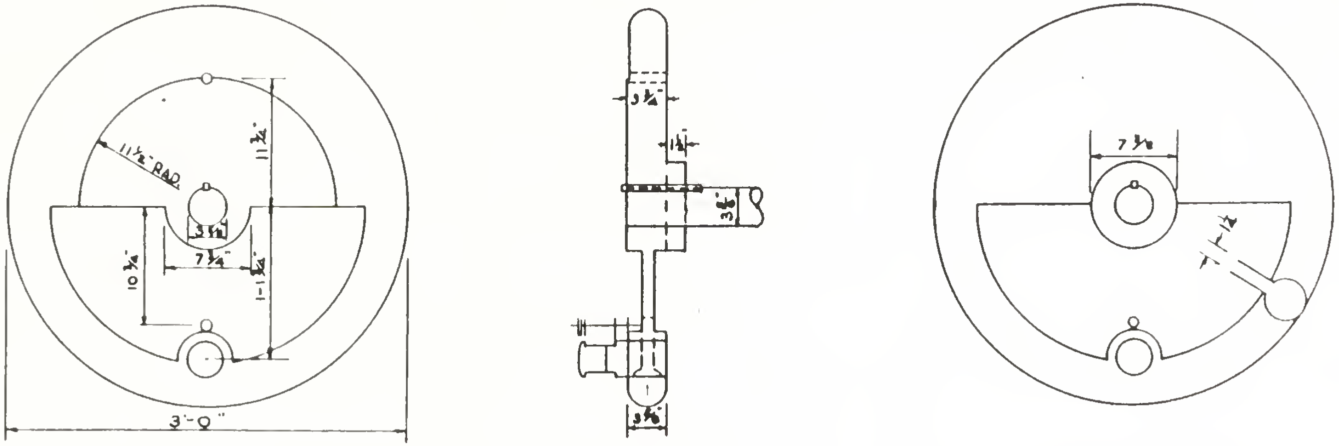
OUTSIDE ELEVATION

SECTION A-A

FRONT ELEVATION

INSIDE ELEVATION

ROSE (WATER) WHEEL



OUTSIDE ELEVATION

SECTION

INSIDE ELEVATION

BALANCE WHEEL

SCALE: 1½" = 1'-0"

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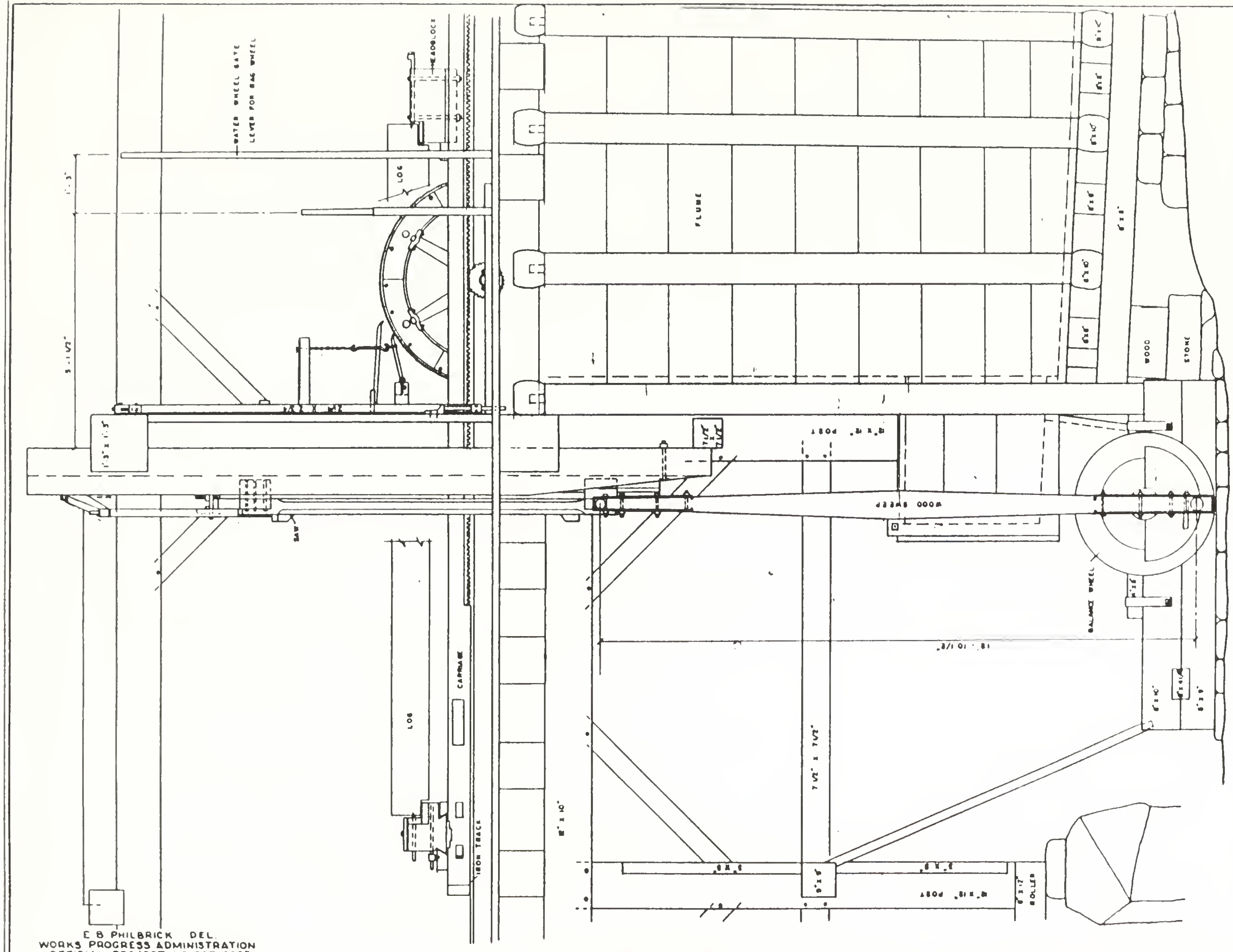

EAST ELEVATION

SCALE 3/4" = 1'-0"

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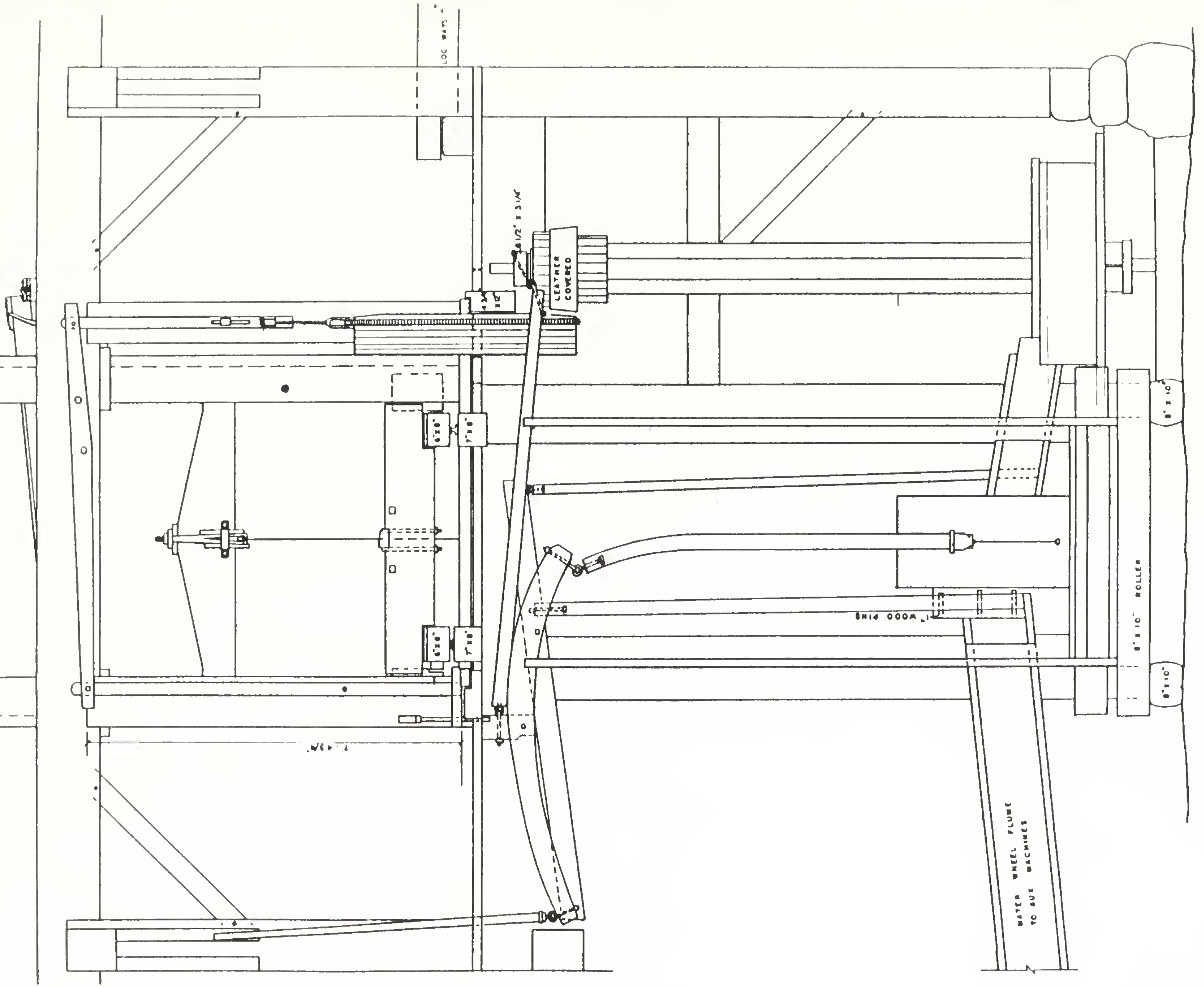
MILL MACHINERY

SCALE: 3/4" = 1'-0"



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Appendix C: Monsanto Data Sheets

MONSANTO MATERIAL SAFETY DATA

MONSANTO PRODUCT NAME

GLYPHOSATE TECHNICAL

MONSANTO COMPANY
800 N. LINDBERGH
ST. LOUIS, MO 63167
EMERGENCY PH. NO. (CALL COLLECT) (314) 694-4000

DATE PREPARED: AUGUST, 1992

PRODUCT IDENTIFICATION

EPA Reg. No.:	524-421	
Synonyms:	None	
Chemical Name:	N-(phosphonomethyl)glycine	
Chemical Formula:	$C_3H_8NO_5P$	
Active Ingredient:	Glyphosate, N-phosphonomethyl glycine....................	76.0%
Inert Ingredients:	....	4.0%
Water:	....	20.0%
		100.0%
CAS Reg. No.:	1071-83-6	
DOT Proper Shipping Name:	Not Applicable	
DOT Hazard Class/I.D. No.:	Not Applicable	
DOT Label:	Not Applicable	
Reportable Quantity (RQ) Under U.S. CERCLA:	Not Applicable	
U.S. Surface Freight Classification:	Technical or intermediate chemical suitable for processing into agricultural herbicides, N.O.I.B.N (Chemicals N.O.I.B.N.)	

SARA Hazard Notification

Hazard Categories Under Criteria of SARA Title III Rules (40 CFR Part 370): Immediate, Delayed

Section 313 Toxic Chemical(s): Not Applicable

Hazardous Chemical(s) Under OSHA Hazard Communication Standard:

This product contains, as a component, the substance listed below which is identified as a hazardous chemical under the criteria of the OSHA Hazard Communication Standard (29 CFR 1910.1200):

N-(Phosphonomethyl)glycine, (CAS Reg. No. 1071-83-6), 76.0% by weight.

WARNING STATEMENTS

CAUTION!
CAUSES (MODERATE) EYE INJURY
FOR MANUFACTURING AND FORMULATING INTO HERBICIDES ONLY

PRECAUTIONARY MEASURES

Avoid contact with eyes or clothing.
Wash thoroughly with soap and water after handling.

Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans or public waters unless this product is specifically identified and addressed in a National Pollution Discharge Elimination System (NPDES) permit. Do not discharge this effluent containing this product into sewer systems without previously notifying the sewage treatment plant authority For guidance, contact your State Water Board or Regional Office of the EPA

EMERGENCY AND FIRST AID PROCEDURES

First Aid:

If in Eyes: Flush eyes with plenty of water. Call physician if irritation persists.

OCCUPATIONAL CONTROL PROCEDURES

Eye Protection: Where there is significant potential for eye contact wear chemical goggles and have eye flushing equipment available.

Skin Protection: Although glyphosate technical does not present a significant skin concern, minimize skin contamination by following good industrial practice. Wash hands and contaminated skin thoroughly after handling.

Respiratory Protection: Avoid breathing dust. Use NIOSH/MSHA approved respiratory protection equipment (full facepiece recommended) when airborne exposure is excessive. If used, full facepiece replaces need for chemical goggles. Consult respirator manufacturer to determine appropriate type equipment for given application. Observe respirator use limitations specified by NIOSH/MSHA or the manufacturer. Respiratory protection programs must comply with 29 CFR §1910.134.

Ventilation: Provide ventilation to minimize exposure. Use local mechanical exhaust ventilation at sources of air contamination such as open process equipment.

Airborne Exposure Limits:

Product: **Glyphosate, 76% by weight:**

OSHA PEL/TWA: None established ACGIH TLV/TWA/STEL: None established

OSHA and ACGIH have not established specific exposure limits for this material. However, OSHA and ACGIH have established limits for nuisance dusts which are the least stringent exposure limits applicable to dusts. The OSHA PEL/TWA for nuisance dusts is 15 mg/m^3 total dust, and 5 mg/m^3 respirable dust. The ACGIH TLV/twa for nuisance dusts is 10 mg/m^3 total dust.

Use control measures as specified above to minimize exposure.

FIRE PROTECTION INFORMATION

Flash Point: Not Applicable **Method:** Tag Closed Cup

Extinguishing Media: Water spray, foam, dry chemical, CO_2, or other class A extinguishing agent.

Special Firefighting Procedures: Firefighters or others who may be exposed to vapors or products of combustion should wear a self-contained breathing apparatus and full protective clothing. Firefighting equipment should be thoroughly cleaned after use.

Unusual Fire and Explosion Hazards: None

REACTIVITY DATA

Stability: Glyphosate technical contains about 20% moisture. This material dries readily when exposed to open air. The dry glyphosate is stable indefinitely when stored at normal temperatures (less than 80°F) Formulations of Glyphosate technical are quite stable under temperatures up to 140°F. However, they will freeze at -20°F, but will go back into solution upon thawing. Heated facilities are not required.

Incompatibility: This product and end use spray solutions of this product should be mixed, stored and applied only in stainless steel, aluminum, fiberglass, plastic and plastic-lined steel containers.

DO NOT MIX, STORE OR APPLY THIS PRODUCT OR SPRAY SOLUTIONS OF THIS PRODUCT IN GALVANIZED OR UNLINED STEEL (EXCEPT STAINLESS STEEL) CONTAINERS OR SPRAY TANKS. This product or spray solutions of this product react with such containers and tanks to produce hydrogen gas which may form a highly combustible gas mixture. This gas mixture could flash or explode, causing serious personal injury, if ignited by open flame, spark, welder's torch, lighted cigarette or other ignition source.

Hazardous Decomposition Products: None

Hazardous Polymerization: Does not occur. This product can react with caustic (basic) materials to liberate heat. This is not a polymerization but rather a chemical neutralization in an acid-base reaction.

HEALTH EFFECTS SUMMARY

The following information summarizes human experience and results of scientific investigations reviewed by health professionals for hazard evaluation of Glyphosate Technical and development of Precautionary Statements and Occupational Control Procedures recommended in this document.

EFFECTS OF EXPOSURE

Skin contact and inhalation are expected to be the primary routes of occupational exposure to Glyphosate Technical. Although occupational exposure to this material has not been reported to cause significant adverse health effects, glyphosate technical is considered, on the basis of acute animal tests, to be moderately to severely irritating to eyes

TOXICOLOGICAL DATA

Data from laboratory studies conducted by Monsanto with glyphosate technical are summarized below.

Single exposure (acute) studies indicate:

Oral -	Practically Nontoxic (Rat LD_{50} - >5,000 mg/kg)
Dermal -	Practically Nontoxic (Rabbit LD_{50} - >5,000 mg/kg)
Eye Irritation -	Moderately to Severely Irritating (Rabbit)
Skin Irritation -	Nonirritating (Rabbit, 4-hr exposure)

COMPONENTS

Glyphosate (Dry, 96%)

Following repeated exposures (90-days) to glyphosate in their feed, decreased weight gains were noted at the highest test level in mice, while no treatment-related effects occurred in rats. Following repeated skin exposure (3 weeks) to glyphosate, slight skin irritation was the primary effect observed in rabbits. No skin allergy was observed in guinea pigs following repeated skin exposure. There was no evidence of effects on the nervous system, including delayed effects in chickens (repeat oral doses) or cholinesterase inhibition in rats (single oral doses).

Reduced body weight gain and effects on liver tissues were observed with long-term (2-year) feeding of glyphosate to mice at high-dose levels. Reduced body weight gain and eye changes were observed at the high-dose level in one long-term (2-year) feeding study with rats, while no treatment-related effects occurred in a second study. No adverse effects were observed in feeding studies with dogs. Glyphosate did not produce tumors in any of these studies. **Based on the results from the chronic studies, EPA has classified glyphosate in Category E (evidence of non-carcinogenicity for humans).**

No birth defects were noted in rats and rabbits given glyphosate orally during pregnancy, even at amounts which produced adverse effects on the mothers. Glyphosate was fed continuously to rats at very high dose levels for 2 successive generations. Toxicity was reported in offspring from the high dose, a level which also produced adverse effects on the mothers. In a 3 generation study conducted at lower dose levels, no effects were seen on the ability of male or female rats to reproduce.

Glyphosate has produced no genetic changes in a variety of standard tests using animals and animal or bacterial cells.

PHYSICAL DATA

Appearance/Odor:	White odorless moist solid
Solubility:	1.57% in water at 25°C. Insoluble in organic solvent.
pH:	2.5 (1% solution in water)
Melting Point:	200°C Decomposes
Vapor Pressure:	1.94×10^{-7} mm/Hg at 45°C
Bulk Density:	0.56 g/ml

NOTE: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specification items.

SPILL, LEAK & DISPOSAL INFORMATION

SPILL/LEAK:

Observe all protection and safety precautions when cleaning up spills -- see Occupational Control Procedures.

Shovel or sweep up spilled material and any contaminated ground, place in a plastic-lined metal drum and dispose of in an approved landfill. Thoroughly scrub floor or other impervious surface involved in spill with a strong industrial type detergent solution and rinse with water.

Do not contaminate water, food, feed or seed by storage or disposal.

DISPOSAL:

Wastes resulting from the use of this product that cannot be used or chemically reprocessed should be disposed of in a landfill approved for pesticide disposal or in accordance with applicable Federal, State or local procedures.

Emptied container retains vapor and product residue. Observe all labeled safeguards until container is cleaned, reconditioned or destroyed.

Drums:	Triple rinse emptied container. Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.
Bulk bag:	Completely empty bag into equipment. Dispose of empty bag in a sanitary landfill or by incineration, or if allowed by local authorities, by burning. If burned, stay out of smoke.

ENVIRONMENTAL EFFECTS

Glyphosate (96%)
The results of single exposure (acute) environmental toxicity studies indicate that glyphosate is no more than slightly toxic to a variety of fish and invertebrates, although it may be highly toxic to slightly toxic to some algae. Following longer-term exposure (21 days) high concentrations of glyphosate, reduced reproduction was observed in the invertebrate *Daphnia magna*. No effects were seen on the ability of fathead minnows to reproduce when exposed to glyphosate.

Single exposure environmental toxicity studies also indicate glyphosate is practically nontoxic by ingestion to honeybees and Bobwhite quail and slightly toxic by ingestion to Spanish goats. No effects were seen on the ability of Bobwhite quail or Mallard ducks to reproduce when fed glyphosate.

A series of residue and metabolism studies have shown that glyphosate is very slowly absorbed across the gastro-intestinal membrane and that there is minimal tissue retention and rapid elimination of residues in several animal species, including mammals, birds and fish. Thus, it is concluded that glyphosate will not bioaccumulate.

DATE: August, 1992 **SUPERSEDES:** June, 1989 **MSDS NO.:** M00014022

FOR ADDITIONAL NON-EMERGENCY INFORMATION, CALL: 314-694-4000

Although the information and recommendations set forth herein (hereinafter "Information") are presented in good faith and believed to be correct as of the date hereof, Monsanto Company makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will Monsanto Company be responsible for damages of any nature whatsoever resulting from the use of or reliance upon Information. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS.

Roundup Herbicide by Monsanto

Glyphosate Technical Fact Sheet

Number 7

January 1994

The Health and Environmental Safety Aspects of Glyphosate Herbicide: An Overview

Introduction

Roundup and other glyphosate-based herbicides made by Monsanto are broad-spectrum herbicides with no soil residual activity. The effectiveness and certain desirable attributes of Roundup herbicide have made it one of the most widely used herbicides in the world today. The Monsanto family of glyphosate-based herbicides is made up of more than 90 different brands used in agricultural, industrial and residential markets in more than 100 countries worldwide.

Monsanto introduced **Roundup herbicide** in 1974 in several markets worldwide. The U.S. Environmental Protection Agency approved registration in 1976 for many agricultural uses and in 1982 approved **Rodeo** herbicide, another glyphosate-based product, for aquatic uses. In 1985, a formulation designed to meet the needs of homeowners, **Roundup L&G Ready-To-Use Grass and Weed Killer,** was registered by Monsanto. **Accord** herbicide, used primarily in forestry and utility rights-of-way settings, was registered in 1986.

Monsanto's glyphosate-based herbicides exhibit certain desirable soil characteristics. For example, they have no residual activity. Tests have shown that they bind tightly to the soil and will not harm near-by vegetation. As a result, there is extremely low potential for contamination of groundwater, when used according to label directions. Once in contact with the soil, glyphosate is broken down by soil microorganisms. And, the process of glyphosate degradation doesn't harm the microorganisms, either.

How Do Glyphosate Herbicides Work?

The active ingredient in Roundup is glyphosate, the common name for N-(phosphonomethyl) glycine. Glyphosate is usually formulated as a water soluble salt to meet a variety of weed control needs. Glyphosate inhibits an enzyme that is essential to formation of specific essential amino acids in the plant. When properly applied to the leaves of actively growing vegetation, glyphosate-based herbicides are absorbed into the above-ground parts of weeds such as green leaves or green stems. Once there, glyphosate moves or "translocates" throughout the plant.

Obvious signs of treatment may not be visible for four days in annual weeds and up to seven days or more in perennials. Visible effects include gradual wilting, yellowing — followed by complete browning, deterioration of plant tissue and ultimate decomposition of the underground roots and rhizomes. Since glyphosate works only on plants that have emerged through the soil, it will not affect seeds that have not yet sprouted.

Are Herbicides Regulated?

Hundreds of separate studies on Roundup and other Monsanto glyphosate products have been reviewed by the EPA for health, safety and environmental effects. In addition, state agencies have carefully reviewed these studies, examined product use for specific geographies, and are responsible for strict registration standards as applied to pesticides. Monsanto's glyphosate herbicide has one of the most extensive worldwide health, safety and environmental effects data bases ever completed on a herbicide, and studies continue today as new requirements come into existence.

Extensive Testing

EPA classified glyphosate in Category E (evidence of non-carcinogenicity for humans), based on a thorough review of results from Monsanto's extensive toxicological tests required by the agency. This very positive rating means that glyphosate has been placed in the most favorable category possible — one that has been given to only a limited number of pesticide active ingredients. (The categories are rated from A through E, with "E" being the most favorable.)

Toxicological testing with laboratory animals serves as a model for evaluating the potential of a substance to cause adverse effects in humans. Toxicology studies measure the effects of direct and indirect exposure to a myriad of substances including herbicides and pharmaceuticals. In addition to these standard tests, numerous studies have also been conducted with Monsanto glyphosate products on other non-target species such as birds, deer, mice, voles, chipmunks and various aquatic organisms.

For example, this diverse testing focused on specifics such as how glyphosate and other herbicides affect birds' ability to lay eggs, the ability of the eggs to survive and the thickness of the egg shells. Other studies examined the impact of glyphosate on habitat change and bacteria in the soil.

ORAL TESTS

The results of acute (single exposure) oral toxicology tests using rats are expressed as LD50 values, or the amount of the substance that produced death in 50 percent of the test animals. EPA places herbicides into one of four categories, with "I" being the most toxic and "IV" the least toxic. Glyphosate is rated as an EPA Category IV compound in oral rat tests. Here are the approximate oral LD50 values for rats fed glyphosate and some other familiar substances to help put these numbers into perspective. The smaller the LD50, the greater the toxicity. (Glyphosate is less toxic to rats than table salt following acute oral ingestion.)

COMPOUND	LD50	TOXICITY
Glyphosate	5,600 mg/kg*	Least
Table salt	3,000 mg/kg	
Vitamin A	2,000 mg/kg	
Aspirin	1,000 mg/kg	
Nicotine	53 mg/kg	Most

*The mg/kg for LD50 values is in milligram test substance per kilogram of body weight.

EYE STUDIES

A common-use spray solution of glyphosate was rated as "slightly irritating" in eye studies. The eye irritation observed following exposure to the spray solution was completely reversible. Recent summaries of accidental eye exposure to Roundup herbicide, for example, showed 97 percent exhibited no or slight irritation or were unrelated to exposure. The remaining 3 percent showed moderate but temporary effects. (Cardinal Glennon Regional Poison Control Center, St. Louis.)

SKIN STUDIES

The acute skin LD50 is greater than 5,000 mg/kg. In acute skin studies using laboratory animals, glyphosate was non-irritating.

INHALATION STUDIES

Glyphosate does not turn into vapor or gas, and inhalation is extremely unlikely when the product is used according to label directions. Since glyphosate has a low vapor pressure, it does not tend to vaporize. The likelihood of vapor inhalation and redistribution by air movement is thus very low.

LONG-TERM TOXICITY TESTS

Long term (chronic) toxicological studies have been conducted to determine the effects of prolonged exposure to glyphosate. These studies were conducted on rats, mice and other laboratory animals. High doses were administered on a daily basis for the average lifetime (two years) of rats and mice and for one year for dogs. Again, these results, described below, contributed to the extensive toxicological data base reviewed by EPA.

ONCOGENICITY TESTS

The results of long-term toxicity tests on glyphosate resulted in glyphosate being classified as Category E.

REPRODUCTIVE AND MUTAGENICITY TESTS

Long-term feeding studies have also shown that Monsanto's glyphosate does not cause birth defects or reproductive problems in laboratory animals. Pregnant rabbits and rats given high-dose levels of glyphosate delivered normal offspring. In a study in which glyphosate was fed continuously over two generations, weight reductions were seen only at a very high-dose level. Lower dose levels in this study and in a three-generation study did not affect the ability of rats to mate, conceive, carry or deliver normal offspring. Nor were any significant adverse effects observed on the ability of those offspring to develop into normal adults.

An extensive battery of mutagenicity and genotoxicity assays designed to evaluate three major objectives — gene mutations, chromosome aberrations and DNA damage and repair — were also performed using glyphosate. The results of these studies show glyphosate does not interfere with the genetic make-up of cells.

Wildlife Effects

The high water solubility of glyphosate suggests that it should not bioaccumulate, which has been confirmed by numerous studies. Work done with laboratory animals shows that glyphosate is poorly absorbed when ingested. Any absorbed glyphosate is rapidly eliminated, resulting in minimal tissue retention. Feeding studies with chickens, cows and pigs have shown extremely low to no residues in meat and fat following repetitive exposure. Negligible residues have also been reported in wild animals such as voles, chipmunks, hares and moose after feeding in treated areas. Similarly, a series of bioaccumulation studies were done to determine if glyphosate concentrated in the edible portions of fish and marine organisms. The results clearly indicated that glyphosate did not accumulate. Moreover, transfer of the organisms to glyphosate-free water resulted in virtually complete elimination of glyphosate. Therefore, the data obtained for numerous studies with mammals, birds, fish and marine organisms firmly support the conclusion that glyphosate will not bioaccumulate in the food chain.

Environmental Fate

In addition to toxicology tests, a completely different set of tests are conducted to determine how the herbicide behaves in the environment. One series of tests is conducted to measure what happens to the herbicide itself when it enters the environment. Some studies measure the tendency of the chemical to bind to the soil and its likelihood of moving through the

soil after rainfall. Other tests measure the ability of microorganisms in the soil to degrade the product.

The results of these tests show that Monsanto's glyphosate-based herbicides exhibit favorable environmental fate characteristics. In fact, these properties facilitate the routine use of glyphosate herbicides in the delicate work of wildlife habitat restoration.

MICROBIALLY DEGRADES

Glyphosate degrades in the soil. The average half-life in soil is less than 45 days. The breakdown of glyphosate takes place primarily by normal soil microbial degradation. Studies show that glyphosate does not accumulate in soil/environment after repeated applications over several years or after repeated applications in one year.

SOIL DISSIPATION

Numerous tests have shown that glyphosate binds tightly to soil particles. In a laboratory study, columns of soil treated with glyphosate were leached continuously with water for 45 days. Results demonstrate that none of the glyphosate was released from the soil. Based on this study and the results of numerous field dissipation studies, it is highly unlikely that glyphosate will move into groundwater.

Residue And Metabolism Studies

Metabolism studies are conducted on crops to determine how a herbicide is metabolized or processed by plants. Residue studies then determine the amount of the parent herbicide or its metabolites that remain in the crop when the herbicide is applied under normal use conditions. Dissipation and residue studies are carried out in a number of locations over a wide geographic range to ensure that the effects of various climates and soil types are examined. If residues are found, studies are then performed to determine if there is any concentration in a particular food fraction such as in flour or vegetable oil.

Based on the results of these residue studies, the EPA establishes tolerance levels, or maximum legal limits, for a herbicide on various crop commodities. These limits are set to ensure that human exposure does not exceed an acceptable level referred to as the Acceptable Daily Intake or ADI. This level is generally 100 times lower than the dose which produced no effects in any animal study. The tolerances set by the EPA are then enforced by the Food and Drug Administration (FDA) which is responsible for monitoring residue levels in domestic and imported crops.

Over a hundred crop metabolism and residue studies have been conducted using Monsanto's glyphosate-based herbicides, on crops ranging from major row crops such as corn and soybeans to tropical fruits. Crop residues are primarily in the negligible range. Public exposure to residues in food crops is extremely low if present at all.

SUMMARY

The results of extensive toxicological studies in animals have demonstrated that glyphosate, the active ingredient in Roundup, Rodeo, Accord, Polado, Roundup L&G Ready-To-Use, Roundup Quik Stik and other Monsanto products, DOES NOT cause carcinogenicity, birth defects, mutagenic effects, neurotoxic effects or reproductive toxicity. In addition, extensive environmental fate studies and reviews have shown that no significant adverse effects to the environment occurred following exposure to Roundup and other Monsanto's glyphosate herbicides.

MONSANTO COMPANY

Monsanto, the manufacturer of Roundup and other glyphosate-based herbicides, encourages the public to become more knowledgeable about its products. More information can be obtained by calling, 1-800-Roundup, or writing to Monsanto Company, 800 N. Lindbergh Blvd., St. Louis, MO 63167.

For additional information, consult the appropriate federal and state supplemental labels for Roundup and other glyphosate herbicides. Roundup, Rodeo, Roundup L&G Ready-To-Use, Roundup Quik Stik, Accord and Polado are registered trademarks of Monsanto Company.

MONSANTO PRODUCT NAME

RODEO® Emerged Aquatic Weed and Brush Herbicide

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ♣

Product Name: RODEO® Emerged Aquatic Weed and Brush Herbicide

Synonyms: None

EPA Reg. No.: 524-343

Company ID: Monsanto Company
800 North Lindbergh
St. Louis, MO 63167, U.S.A.

Phone #s: Emergency Phone Number (call collect): (314) 694-4000
Non-Emergency Information: 1-800-332-3111

Revisions: Sections containing a revision or new information are marked with a ♣

MSDS Number: S00010153 **Date: November, 1994** **Supersedes: March, 1993**

2. COMPOSITION INFORMATION ON INGREDIENTS ♣

Chemical Ingredients: *Active Ingredient:* Glyphosate, N-(phosphonomethyl) glycine, in the form of its isopropylamine salt .... 53.8 %

Inert Ingredients: .... 46.2 %

100.0%

Component	**CAS Reg No**	**% by Wt**
Glyphosate, isopropylamine salt	38641-94-0	53.8%

* NO Hazardous chemicals under the criteria of the OSHA Hazard Communication Standard (29 CFR §1910 1200)

See Section 8 for exposure limits.

3. HAZARDS IDENTIFICATION ♣

Emergency Overview:

Appearance & Odor: Colorless and odorless solution

Warning Statements:
- Keep out of reach of children.
- CAUTION!
- HARMFUL IF INHALED

Potential Adverse Health Effects:

Likely Routes of Exposure: Inhalation and skin contact

Eye Contact: No more than slightly irritating based on toxicity studies.

Skin Contact: No more than slightly toxic or irritating based on toxicity studies

Ingestion: No more than slightly toxic based on toxicity studies. No significant adverse health effects are expected to develop if only small amounts (less than a mouthful) are swallowed.

Inhalation: No more than slightly toxic if inhaled based on toxicity studies.

Refer to Section 11 for toxicological information.

4. FIRST AID MEASURES ♣

If Inhaled: Remove individual to fresh air Seek medical attention if breathing difficulty develops.

NOTE: For additional human emergency first aid or treatment guidance, call collect, anytime, day or night (314) 694-4000.

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5. FIRE FIGHTING MEASURES

Flash Point:	This material is not combustible as tested by the Tag Cup Test.
Auto Ignition Temperature:	Not determined
Extinguishing Media:	Use appropriate extinguishing media for exposure fire.
Special Fire Fighting Procedures:	Firefighters and others that may be exposed to vapors, mists, dusts, or products of combustion should wear full protective clothing and self-contained breathing apparatus. Equipment should be thoroughly cleaned after use.
Unusual Fire or Explosion Hazards:	None

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6. ACCIDENTAL RELEASE MEASURES ♣

Observe all protection and safety precautions when cleaning up spills - See Exposure Controls/Personal Protection, Section 8

Small Spills: For a spill less than one gallon on floor or other impervious surface, soak up with towels or other absorbent material and discard in the trash. Clean the spill area with soap and water and rinse the area thoroughly.

Large Liquid Spills on the floor or other impervious surface should be contained or diked and then absorbed with attapulgite, bentonite or other absorbent clays. Collect the contaminated absorbent, place in a metal drum and dispose of in accordance with the instructions provided under Disposal, Section 13 of this MSDS. Thoroughly scrub floor or other impervious surface with a strong industrial detergent and rinse with water.

Large spills that soak into the ground should be dug up, placed in metal drums and disposed of in accordance with instructions provided under DISPOSAL, Section 13 of this MSDS. Contact appropriate state agency when considering a land spreading disposal option.

Leaking containers should be separated from non-leakers and either the container or its contents transferred to a drum or other non-leaking container and disposed of in accordance with instructions provided under DISPOSAL, Section 13 of this MSDS. Any recovered spilled liquid should be similarly collected and disposed of.

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7. HANDLING AND STORAGE ♣

Handling:

- Avoid breathing vapors or spray mist
- Remove contaminated clothing and wash clothing before reuse.
- Wash thoroughly with soap and water after handling.
- Do not contaminate water when disposing of equipment wash waters.
- Treatment of aquatic weeds can result in oxygen depletion or loss due to decomposition of dead plants. This oxygen loss can cause fish suffocation.

Storage:

- STORE ABOVE 10 F (-12 C) TO KEEP FROM CRYSTALLIZING.
- Crystals will settle to the bottom. If allowed to crystallize, place in a warm room at 68 F (20 C) for several days to redissolve and mix well before using
- Do not contaminate water, foodstuffs, feed or seed by storage or disposal.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Personal Protective Equipment:

Eye Protection: RODEO® Emerged Aquatic Weed and Brush herbicide does not present significant eye irritation or eye toxicity requiring special protection. Avoid eye contact as good industrial practice.

Skin Protection: RODEO® Emerged Aquatic Weed and Brush herbicide does not present significant skin concern requiring special protection.

Respiratory Protection: For Handling of the Undiluted Product: Undiluted RODEO® Emerged Aquatic Weed and Brush herbicide is not likely to represent an airborne exposure concern during normal handling. In the event of an accidental discharge of the material during manufacture or handling which produces a heavy vapor or mist, workers should put on respiratory protection equipment. Consult respirator manufacturer to determine appropriate type of equipment. Observe respirator use limitations specified by NIOSH/MSHA or the manufacturer. Respiratory protection programs must comply with 29 CFR §1910 134.

For Application of Product Diluted in accordance with label instructions: Respirators are not required for applications of use - dilutions of RODEO® Emerged Aquatic Weed and Brush herbicide.

Ventilation: No special precautions are recommended.

Exposure Guidelines:

Exposure Limits	OSHA PEL	ACGIH TLV
RODEO®	None established	None established

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9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Colorless solution

Odor: Essentially odorless

pH: 4.6 - 4.8

Specific Gravity: 1.22 - 1.25 (water = 1)

Note: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specification items.

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10. STABILITY AND REACTIVITY

Chemical Stability: Stable for at least 5 years under normal conditions of warehouse storage. Heated facilities are not required.

Conditions to Avoid: Store above 10 F (-12 C) to keep from crystallizing.

Incompatibility with Other Materials: Spray solutions of this product should be mixed, stored and applied using only stainless steel, aluminum, fiberglass, plastic and plastic-lined steel containers.

DO NOT MIX, STORE OR APPLY THIS PRODUCT OR SPRAY SOLUTIONS OF THIS PRODUCT IN GALVANIZED OR UNLINED STEEL (EXCEPT STAINLESS STEEL) CONTAINERS OR SPRAY TANKS. This product or solutions of this product react with such containers and tanks to produce hydrogen gas which may form a highly combustible gas mixture. This gas mixture could flash or explode, causing serious personal injury, if ignited by open flame, spark, welder's torch, lighted cigarette or other ignition source.

Hazardous Decomposition Products:	None known
Hazardous Polymerization:	Does not occur. This product can react with caustic (basic) materials to liberate heat. This is not a polymerization but rather a chemical neutralization in an acid-base reaction.

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11. TOXICOLOGICAL INFORMATION ♣

TOXICOLOGICAL DATA

Data from laboratory studies conducted by Monsanto with RODEO® Emerged Aquatic Weed and Brush herbicide are summarized below.

Oral -	Practically Non-toxic, (Rat LD_{50} - >5,000 mg/kg)
Dermal -	Practically Non-toxic, (Rabbit LD_{50} - >5000 mg/kg)
Inhalation -	Slightly Toxic, (Rat 4-hr LC_{50} - > 1.3 mg/l, the highest atmospheric concentration achievable in this study); FIFRA Category III, Not DOT poisonous
Eye Irritation -	Non irritating, - Rabbits (6 animals); 24-hr exp.; Draize Average: 0.0/110; EU: Corneal Opacity - 0.0, Iris - 0.0, Erythema - 0.0, Chemosis - 0.0
Skin Irritation -	Practically Nonirritating - Rabbits (6 animals); 24-hr exp.; Draize Average: 0.1/8.0; EU: Erythema - 0.1, Edema - 0.0

In repeat dosing studies (6-months), dogs fed RODEO® Emerged Aquatic Weed and Brush herbicide exhibited slight body weight changes. Following repeated skin exposure (3-weeks) to RODEO® Emerged Aquatic Weed and Brush herbicide, skin irritation was the only effect in rabbits. No skin allergy was observed in guinea pigs following repeated skin exposure.

Additional toxicity information is available on glyphosate, the active herbicidal ingredient of RODEO® Emerged Aquatic Weed and Brush herbicide. Following repeated exposures (90-days) to glyphosate in their feed, decreased weight gains were noted at the highest test level in mice, while no treatment-related effects occurred in rats. Following repeated skin exposure (3 weeks) to glyphosate, slight skin irritation was the primary effect observed in rabbits. No skin allergy was observed in guinea pigs following repeated skin exposure. There was no evidence of effects on the nervous system, including delayed effects in chickens (repeat oral doses) or cholinesterase inhibition in rats (single oral doses). Reduced body weight gain and effects on liver tissues were observed with long-term (2-year) feeding of glyphosate to mice at high-dose levels. Reduced body weight gain and eye changes were observed at the high-dose level in one long-term (2 year) feeding study with rats, while no treatment-related effects occurred in a second study. No adverse effects were observed in feeding studies with dogs. Glyphosate did not produce tumors in any of these studies. **Based on the results from the chronic studies, EPA has classified glyphosate in category E (evidence of non-carcinogenicity for humans)**. No birth defects were noted in rats and rabbits given glyphosate orally during pregnancy, even at amounts which produced adverse effects on the mothers. Glyphosate was fed continuously to rats at very high dose levels for 2 successive generations. Toxicity was reported in offspring from the high dose, a level which also produced adverse effects on the mothers. In a 3 generation study conducted at lower dose levels, no effects were seen on the ability of male or female rats to reproduce. Glyphosate has produced no genetic changes in a variety of standard tests using animals and animal or bacterial cells.

12. ECOLOGICAL INFORMATION

96-hr LC_{50} Bluegill:	>1,000 mg/l, Practically Nontoxic
96-hr LC_{50} Trout:	>1,000 mg/l, Practically Nontoxic
48-hr EC_{50} *Daphnia*:	930 mg/l, Practically Nontoxic
Oral LD_{50} Goat:	5,700 mg/kg, Practically Nontoxic

Brahman-cross heifers were given RODEO® Emerged Aquatic Weed and Brush herbicide, by gavage, at daily dosages of 0, 540, 830, 1290 and 2000 mg/kg for 7 consecutive days. Clinical signs of toxicity, including loss of appetite, diarrhea and death (1290 and 2000 mg/kg) were observed at 830 mg/kg or above. The no-effect level was considered to be 540 mg/kg/day.

For environmental toxicity information with Glyphosate, the active herbicidal ingredient of RODEO® Emerged Aquatic Weed and Brush herbicide, refer to the Glyphosate Material Safety Data Sheet.

13. DISPOSAL CONSIDERATIONS

Wastes resulting from the use of this product that cannot be used or chemically reprocessed should be disposed of in a landfill approved for pesticide disposal or in accordance with applicable Federal, State and local procedures.

Emptied container retains vapor and product residue. Observe all labeled safeguards until container is cleaned, reconditioned or destroyed.

Do not reuse container. Return emptied container per the Monsanto container return program. If not returned, triple rinse container, then puncture and dispose of in a sanitary landfill or by incineration or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.

14. TRANSPORT INFORMATION ♣

Follow the precautions indicated in the Handling and Storage Section, Section 7 of this MSDS.

DOT Proper Shipping Name:	Not Applicable
DOT Hazard Class/I.D. No.:	Not Applicable
DOT Label:	Not Applicable
U.S. Surface Freight Classification:	Weed killing compound, N.O.I.B.N.

15. REGULATORY INFORMATION

SARA Hazard Notification:

Hazard Categories Under Criteria of SARA Title III Rules (40 CFR Part 370): Not applicable

Section 313 Toxic Chemical(s): Not Applicable

Hazardous Chemical(s) Under OSHA Hazard Communication Standard: Not Applicable

Reportable Quantity (RQ) under U.S. CERCLA: Not Applicable

TSCA Inventory: All components are on the US EPA's TSCA Inventory List

16. OTHER

Reasons for revision New CMA Format; New name; Correct ingredient %s; update spill procedures

This Material Safety Data Sheet (MSDS) serves different purposes than and DOES NOT REPLACE OR MODIFY THE EPA-APPROVED PRODUCT LABELING (attached to and accompanying the product container). This MSDS provides important health, safety, and environmental information for employers, employees, emergency responders and others handling large quantities of the product in activities generally other than product use, while the labeling provides that information specifically for product use in the ordinary course.

Use, storage and disposal of pesticide products are regulated by the EPA under the authority of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) through the product labeling, and all necessary and appropriate precautionary, use, storage, and disposal information is set forth on that labeling. It is a violation of federal law to use a pesticide product in any manner not prescribed on the EPA-approved label.

Although the information and recommendations set forth herein (hereinafter "Information") are presented in good faith and believed to be correct as of the date hereof, Monsanto Company makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will Monsanto Company be responsible for damages of any nature whatsoever resulting from the use of or reliance upon Information. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS.

RODEO® is a registered trademark of Monsanto Company MSDSR 50

Printed on recycled paper (10% postconsumer waste)

RODEO
EMERGED AQUATIC WEED AND BRUSH HERBICIDE
Monsanto

Rodeo Technical Fact Sheet

Number 2

August 1993

THIS FACT SHEET IS MEANT TO BE USED AS A COMPANION TO "Glyphosate Technical Fact Sheet."

Introduction

Rodeo herbicide — which is made up of glyphosate, its active ingredient, and water — controls undesirable aquatic vegetation in wildlife habitat and refuge areas, lakes, ponds, canals, estuary and intertidal zones and other aquatic sites. Vegetation management professionals can apply Rodeo herbicide according to label directions with virtually no risk of adversely affecting human health, wildlife or water quality.

Health and Safety

Rodeo herbicide has been evaluated in numerous studies with laboratory animals and wildlife species using exposure levels far in excess of those resulting from labeled use of the herbicide. Data from laboratory studies conducted with Rodeo herbicide are summarized in Tables 1 and 2.

Rodeo Herbicide
TABLE 1

Exposure Route	Animal	Toxicity	EPA Category*
Oral	rat	>5,000 mg/kg	IV
Dermal	rabbit	>5,000 mg/kg	IV

Eye and skin irritation studies have also been conducted. The results are presented in Table 2. The test results are expressed as a numerical value based on a scale that reflects the increasing degree of irritation. This scale ranges from 0 (no effect) to 110.0 (maximum irritation) for eyes and 0 to 8.0 for skin.

Rodeo Herbicide
TABLE 2

Exposure Route	Animal	Irritation Score
Eye	rabbit	0.0, on a scale of 110.0 (non-irritating)
Skin	rabbit	0.1 on a scale of 8.0 (practically non-irritating)

Environmental Fate

The favorable environmental fate characteristics of Rodeo herbicide are well-known. More than 400 studies have been conducted on glyphosate — the active ingredient in Rodeo — which means the environmental data base on glyphosate is among the most extensive of any herbicide on the market today. For more specific information regarding the environmental fate of glyphosate, please see accompanying text in "Glyphosate Technical Fact Sheet."

The dissipation of glyphosate in sterile and non-sterile water has been studied extensively. Laboratory experiments indicate that glyphosate dissipates rapidly from water (half-lives of approximately seven to eight days) by binding tightly to suspended soil particles, deposition in bottom sediment and microbial degradation. In most natural water systems, the constant motion and influx of new water results in rapid glyphosate dissipation.

Bioaccumulation

In studies performed with glyphosate, the bioconcentration factors for fish tissues demonstrated that glyphosate does not accumulate in fish. In fact, the low bioaccumulation factor is a result of glyphosate being readily soluble in water and therefore being eliminating quickly from organisms in water. Other animal species studied with similar conclusions include marine mollusks and crustaceans.

Moreover, tissue analyses showed that of the trace amounts of glyphosate residue found, more than 75 percent was contained in non-edible portions of the fish. When exposed fish were transferred to glyphosate-free water, virtually all of the glyphosate was eliminated from their tissues.

No Volatility

Rodeo herbicide is non-volatile. That means that Rodeo does not produce vapors that could move through air and damage non-target vegetation, and there are no odors to disturb the public.

Thermal Degradation Studies

Some vegetation management practices involve the burning of weeds and brush following herbicide application

tion. An assessment of the thermal decomposition products of glyphosate clearly shows that they will not cause adverse effects to individuals exposed to the smoke and gases formed as a result of burning treated vegetation. This assessment is based on an application rate of 7½ pints Rodeo herbicide/acre, and zero decomposition of glyphosate prior to burning.

Ecosystem Studies

Because Rodeo and other glyphosate-based herbicides are widely used throughout the world, ecosystem studies have been conducted to assess what effect, if any, the use of glyphosate has on an ecosystem. Results from two landmark, independently conducted and comprehensive ecosystem studies — the Canadian Carnation Creek Study[1] and the Oregon State University[2] study — showed:

Rodeo herbicide, when used according to label directions:

- Degrades in soil
- Is essentially immobile in soil
- Is not a threat to either groundwater or surface water
- Does not cause adverse health or migrational changes in fish
- Has no effect on aquatic or terrestrial invertebrates or waterfowl.

Habitat Restoration & Enhancement

Confirmed results such as these have led various habitat restoration and wildlife protection groups to use Rodeo herbicide in the restoration and maintenance of wildlife habitat and refuge areas. Additionally, state departments of natural resources, environment and fish and game commonly choose Rodeo herbicide for use in delicate aquatic areas.

No Water Restrictions

When applying Rodeo according to label directions, there are no restrictions on the use of water for irrigation, recreation or domestic purposes. Residue levels of glyphosate in water have been found not to exceed the acceptable level established by the EPA. Studies showed that because glyphosate dissipates rapidly in water, crops irrigated with water from areas treated with Rodeo will not be affected. Nor will they have unacceptable residue levels.

The acute toxicological effects of exposure to Rodeo herbicide and glyphosate were also assessed with a wide variety of aquatic species. The results in Table 3 show that both Rodeo and glyphosate are practically non-toxic to most aquatic species tested.

TABLE 3

Rodeo Herbicide Aquatic Toxicity Data

96-hour LC50 Bluegill Sunfish	>1,000 mg/l (practically non-toxic)
96-hour LC50 Trout	>1,000 mg/l (practically non-toxic)
96-hour LC50 Carp	>10,000 mg/l (practically non-toxic)
48-hour EC50 *Daphnia magna*	930 mg/l (practically non-toxic)

Glyphosate Aquatic Toxicity Data

96-hour LC50 Grass shrimp	281 mg/l (practically non-toxic)
96-hour LC50 Mysid shrimp	>1,000 mg/l (practically non-toxic)
96-hour EC50 Sea urchin	>1,000 mg/l (practically non-toxic)
96-hour LC50 Fiddler crab	934 mg/l (practically non-toxic)
48-hour LC50 Oyster larvae	>10 mg/l (slightly toxic)

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[1] [illegible] de [illegible] Forests Research Branch, 1989)

[2] Newton, M., Howard, K.M., Kelpsas, B.R., Danhaus, R., Lottman, C.M. and S. Dubelman [illegible] Fate of Glyphosate in an Oregon Forest Ecosystem [illegible] Agricultural and [illegible] 32:1144

Based on a glyphosate aquatic concentration study conducted by the National Taiwan University, Taiwan, it was calculated that a 2 pt/acre application of Rodeo herbicide to a static pond would result in an instantaneous glyphosate water concentration of 1.0 ppm (mg/l). A comparison of this concentration level with the LC50 levels in Table 3 shows that when Rodeo herbicide is used at labelled rates it is highly unlikely that glyphosate concentrations would ever reach levels harmful to aquatic species.

In a study conducted by Auburn University to assess the effect of various herbicides on submerged aquatic vegetation, glyphosate was shown to be essentially non-toxic to submerged aquatic flora at concentrations as high as 1 ppm in a static environment.[4] The authors concluded that "glyphosate would appear to pose no threat to non-target, submersed aquatic plants."

Chronic toxicity studies have also been performed to determine the effects of prolonged exposure to glyphosate. Those studies are summarized in the accompanying "Glyphosate Technical Fact Sheet."

SUMMARY

When properly applied at labelled rates, Rodeo herbicide offers known favorable toxicology and environmental characteristics. This combination gives applicators vast flexibility for controlling over 170 weeds in aquatic uses in residential, commercial, public and wildlife refuges — nearly anywhere weeds and water coexist.

[illegible] Chang [illegible] glyphosate [illegible] Weed Research [illegible]

[4] [illegible] submerged Aquatic [illegible]

MONSANTO PRODUCT NAME

ACCORD® Herbicide

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name:	ACCORD® herbicide
Synonyms:	None
EPA Reg. No.:	524-326
Company ID:	Monsanto Company 800 North Lindbergh St. Louis, MO 63167, U.S.A.
Phone #s:	Emergency Phone Number (call collect): (314) 694-4000 Non-Emergency Information: 1-800-332-3111
Revisions:	Sections containing a revision or new information are marked with a ♣

MSDS Number: **S00011151** **Date:** **August, 1995** **Supersedes:** **Setptember, 1993**

2. COMPOSITION INFORMATION ON INGREDIENTS ♣

Chemical Ingredients: *Active Ingredient:* Glyphosate, N-(phosphonomethyl) glycine, in the form of its isopropylamine salt .... 41.5 %

Inert Ingredients: .... 58.5 %

100.0%

Component	CAS Reg No	% by Wt
Glyphosate, isoprpylamine salt	38641-94-0	41.5%

NO Hazardous chemicals under the criteria of the OSHA Hazard Communication Standard (29 CFR §1910 1200)

NO SARA 313 toxic chemicals

See Section 8 for exposure limits.

3. HAZARDS IDENTIFICATION

Emergency Overview:

Appearance & Odor: Colorless solution, essentially odorless

Warning Statements: Keep out of reach of children.
CAUTION!
HARMFUL IF INHALED
REFORMULATION IS PROHIBITED
SEE CONTAINER LABEL FOR REPACKAGING LIMITATIONS

Potential Adverse Health Effects:

Likely Routes of Exposure: Inhalation and skin contact

Eye Contact:	ACCORD® herbicide is no more than slightly irritating based on toxicity studies.
Skin Contact:	ACCORD® herbicide is no more than slightly irritating based on toxicity studies.
Ingestion:	ACCORD® herbicide is no more than slightly toxic based on toxicity studies. No significant adverse health effects are expected to develop if only small amounts (less than a mouthful) are swallowed.
Inhalation:	ACCORD® herbicide is no more than slightly toxic if inhaled based on toxicity studies

4. FIRST AID MEASURES

If Inhaled: Remove individual to fresh air. Seek medical attention if breathing difficulty develops.

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5. FIRE FIGHTING MEASURES

Flash Point:	>200°F **Method:** Tag Closed Cup
Auto Ignition Temperature:	Not determined
Extinguishing Media:	Water spray, foam, dry chemical, CO_2, or other class B extinguishing agent.
Special Fire Fighting Procedures:	Firefighters and others that may be exposed to vapors, mists, dusts, or products of combustion should wear full protective clothing and self-contained breathing apparatus. Equipment should be thoroughly cleaned after use.
Unusual Fire or Explosion Hazards:	None

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6. ACCIDENTAL RELEASE MEASURES

Observe all protection and safety precautions when cleaning up spills - See Exposure Controls/Personal Protection, Section 8.

Small Spills: For a spill less than one gallon on floor or other impervious surface, soak up with towels or other absorbent material and discard in the trash. Clean the spill area with soap and water and rinse the area thoroughly.

Large Liquid Spills on the floor or other impervious surface should be contained or diked and then absorbed with attapulgite, bentonite or other absorbent clays. Collect the contaminated absorbent, place in a metal drum and dispose of in accordance with the instructions provided under Disposal, Section 13 of this MSDS. Thoroughly scrub floor or other impervious surface with a strong industrial detergent and rinse with water.

Large spills that soak into the ground should be dug up, placed in metal drums and disposed of in accordance with instructions provided under DISPOSAL, Section 13 of this MSDS. Contact appropriate state agency when considering a land spreading disposal option.

Leaking containers should be separated from non-leakers and either the container or its contents transferred to a drum or other non-leaking container and disposed of in accordance with instructions provided under DISPOSAL, Section 13 of this MSDS. Any recovered spilled liquid should be similarly collected and disposed of.

---

7. HANDLING AND STORAGE

Handling:

- Do not contaminate water when disposing of equipment washwaters. Treatment of aquatic weeds can result in oxygen depletion or loss due to decomposition of dead plants. This oxygen loss can cause fish suffocation.

Storage:

- Store above 10°F (-12°C) to keep from crystallizing.
- Crystals will settle to the bottom. If allowed to crystallize, place in a warm room 68°F (20°C) for several days to redissolve, and roll or shake container or recirculate in mini-bulk containers to mix well before using. For bulk containers, see container label.
- Do not contaminate water, foodstuffs, feed or seed by storage or disposal.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Personal Protective Equipment:

Eye Protection: This product does not cause significant eye irritation or eye toxicity requiring special protection. Use good handling practices to avoid eye contact.

Skin Protection: Although this product does not present a significant skin concern, minimize skin contamination by following good handling practices. Applicators and other handlers must wear: long sleeved shirt, long pants, and shoes with socks. Wash hands and contaminated skin thoroughly after handling.

Respiratory Protection: Avoid breathing mist or vapor. This product is not likely to pose an airborne exposure concern when handled and used in accordance with label instructions.

Ventilation: No special precautions are recommended.

Exposure Guidelines:

Exposure Limits	OSHA PEL	ACGIH TLV
ACCORD® herbicide	None established	None established

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9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Colorless solution

Odor: Essentially odorless

pH: 4.6 - 4.8

Specific Gravity: 1.158 (Water = 1)

Note: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specification items.

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10. STABILITY AND REACTIVITY

Chemical Stability: Stable for at least 5 years under normal conditions of warehouse storage. Heated facilities are not required. (See Storage, Spill/Leak & Disposal Information)

Conditions to Avoid: Store above 10 F (-12 C) to keep from crystallizing.

Incompatibility with Other Materials: Spray solutions of this product should be mixed, stored and applied only using stainless steel, aluminum, fiberglass, plastic and plastic-lined steel containers.

DO NOT MIX, STORE OR APPLY THIS PRODUCT OR SPRAY SOLUTIONS OF THIS PRODUCT USING GALVANIZED OR UNLINED STEEL (EXCEPT STAINLESS STEEL) CONTAINERS OR SPRAY TANKS. This product or solutions of this product react with such containers and tanks to produce hydrogen gas which may form a highly combustible gas mixture. This gas mixture could flash or explode, causing serious personal injury, if ignited by open flame, spark, welder's torch, lighted cigarette or other ignition source.

Hazardous Decomposition Products: None known

Hazardous Polymerization: Does not occur. This product can react with caustic (basic) materials to liberate heat. This is not a polymerization but rather a chemical neutralization in an acid-base reaction.

11. TOXICOLOGICAL INFORMATION

TOXICOLOGICAL DATA

Data from laboratory studies conducted by Monsanto with Accord® herbicide or a product of similar composition are summarized below

Oral -	Rat LD_{50} - >5,000 mg/kg; FIFRA Category IV
Dermal -	Rabbit LD_{50} - >5000 mg/kg; FIFRA Category IV
Inhalation -	Rat 4-hr LC_{50} - >1.3 mg/L, the highest atmospheric concentration achievable in this study; FIFRA Category III
Eye Irritation -	Rabbit (6 animals), 24-hr exp.; FIFRA Category IV EU: Corneal Opacity - 0.0, Iris - 0.0, Erythema - 0.0, Chemosis - 0.0
Skin Irritation -	Rabbit, (6 animals), 24-hr exp.; FIFRA Category IV EU: Erythema - 0.1, Edema - 0.0

Isopropylamine Salt of Glyphosate

Data from studies with a formulation comprised of 62% isopropylamine salt of glyphosate (MON 0139) indicate the following:

In repeat dosing studies (6-month), dogs fed MON 0139 exhibited slight body weight changes. Following repeated skin exposure (3-week) to MON 0139, skin irritation was the primary effect in rabbits.

Additional toxicity information is available on glyphosate, the active herbicidal ingredient of MON 0139. Following repeated exposures (90-days) to glyphosate in their feed, decreased weight gains were noted at the highest test level in mice, while no treatment-related effects occurred in rats. Following repeated skin exposure (3 weeks) to glyphosate, slight skin irritation was the primary effect observed in rabbits. No skin allergy was observed in guinea pigs following repeated skin exposure. There was no evidence of effects on the nervous system, including delayed effects in chickens (repeat oral doses) or cholinesterase inhibition in rats (single oral doses). Reduced body weight gain and effects on liver tissues were observed with long-term (2-year) feeding of glyphosate to mice at high-dose levels. Reduced body weight gain and eye changes were observed at the high-dose level in one long-term (2 year) feeding study with rats, while no treatment-related effects occurred in a second study. No adverse effects were observed in feeding studies with dogs. Glyphosate did not produce tumors in any of these studies. **Based on the results from the chronic studies, EPA has classified glyphosate in category E (evidence of non-carcinogenicity for humans).** No birth defects were noted in rats and rabbits given glyphosate orally during pregnancy, even at amounts which produced adverse effects on the mothers. Glyphosate was fed continuously to rats at very high dose levels for 2 successive generations. Toxicity was reported in offspring from the high dose, a level which also produced adverse effects on the mothers. In a 3 generation study conducted at lower dose levels, no effects were seen on the ability of male or female rats to reproduce. Glyphosate has produced no genetic changes in a variety of standard tests using animals and animal or bacterial cells.

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12. ECOLOGICAL INFORMATION

96-hr LC_{50} Bluegill:	>1,000 mg/L, Practically Nontoxic
96-hr LC_{50} Trout:	>1,000 mg/L, Practically Nontoxic
48-hr EC_{50} *Daphnia*:	930 mg/L, Practically Nontoxic

13. DISPOSAL CONSIDERATIONS

Wastes resulting from the use of this product that cannot be used or chemically reprocessed should be disposed of in a landfill approved for pesticide disposal or in accordance with applicable Federal, State or local procedures.

Emptied container retains vapor and product residue. Observe all labeled safeguards until container is cleaned, reconditioned or destroyed.

Do not reuse container. Triple rinse container, then puncture and dispose of in a sanitary landfill or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

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14. TRANSPORT INFORMATION

Follow the precautions indicated in the Handling and Storage Section, Section 7 of this MSDS.

DOT Proper Shipping Name:	Not Applicable
DOT Hazard Class/I.D. No.:	Not Applicable
DOT Label:	Not Applicable
U.S. Surface Freight Classification:	Weed killing compound, N.O.I.B.N.

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15. REGULATORY INFORMATION

SARA Hazard Notification:

Section 302/304 - Emergency Planning and Release Notification:
This product does NOT contain a listed extremely hazardous substance.

Hazard Categories Under Criteria of SARA Title III Rules (40 CFR Part 370): None

Section 313 Toxic Chemical(s): Not Applicable

Hazardous Chemical(s) Under OSHA Hazard Communication Standard: Not Applicable

Reportable Quantity (RQ) under U.S. CERCLA: Not Applicable

TSCA Inventory: All components are on the US EPA's TSCA Inventory List

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16. OTHER

Reasons for revision: Change component/CAS No. to Isopropylamine salt of Gly; correct ommission/typo in Sect. 15.

This Material Safety Data Sheet (MSDS) serves different purposes than and DOES NOT REPLACE OR MODIFY THE EPA-APPROVED PRODUCT LABELING (attached to and accompanying the product container). This MSDS provides important health, safety, and environmental information for employers, employees, emergency responders and others handling large quantities of the product in activities generally other than product use, while the labeling provides that information specifically for product use in the ordinary course.

Use, storage and disposal of pesticide products are regulated by the EPA under the authority of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) through the product labeling, and all necessary and appropriate precautionary, use, storage, and disposal information is set forth on that labeling. It is a violation of federal law to use a pesticide product in any manner not prescribed on the EPA-approved label.

Although the information and recommendations set forth herein (hereinafter "Information") are presented in good faith and believed to be correct as of the date hereof, Monsanto Company makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will Monsanto Company be responsible for damages of any nature whatsoever resulting from the use of or reliance upon Information. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS.

ACCORD® is a registered trademark of Monsanto Company. ACCORD.895

Printed on recycled paper (10% postconsumer waste)

Appendix D: State Pesticide Bureau Approved Herbicide Lists

The following is the "LIST" of recommended herbicides for use in sensitive areas within Rights-of-Way pursuant to 333 CMR 11.04(1)(c).

Trade Name	EPA Reg. No.	Active Ingredient	Use Restrictions
Accord	524-326	Glyphosate	None
Rodeo	524-343	Glyphosate	None
Roundup	524-308	Glyphosate	None
Roundup PRO	524-475	Glyphosate	None
Arsenal	241-273	Imazapyr	3 Pints/acre Every 3rd Year or 2 Pints Every Other Year
Chopper RTU	241-330	Imazapyr	None
Arsenal NS	241-346	Imazapyr	3 Pints/acre Every 3rd Year or 2 Pints Every Other Year
Krenite	352-376	Fosamine Ammonium	None
Krenite S	352-395	Fosamine Ammonium	None
Krenite UT	352-395	Fosamine Ammonium	None
Escort	352-439	Metsulfuron Methyl	None
Banvel CST	55947-32	Dicamba	Sponge Application to Cut Stump
Garlon 4	464-554	(Butoxy ethyl ester Triclopyr)	0.5 Pints/acre within 10 feet; 3.0 pints/acre within 50 feet
Oust	352-401	Sulfometuron methyl	None

Applications of herbicides for the purpose of railroad Rights-of-Way maintenance which are not recommended above are subject to the provisions of MGL c.131 Section 40, and MGL c.21A Section 2, and regulations promulgated thereunder.

The following is a list of herbicides which applicants have requested for evaluation for use on Rights-of-Way. These herbicides have been evaluated and are **NOT RECOMMENDED** for use in sensitive areas within Rights-of-Way pursuant to 333 CMR 11.00 for the specified reason(s).

Trade Name	EPA Reg. No.	Active Ingredient	Reason
Weedar 64A	264-143	2,4-D (Diethanolamine salt)	Tank mix with not recommended herbicide
Formula 40	464-1-39511	2,4-D (Triisopropanol amine salt)	Tank mix with not recommended herbicide
Access	464-576	Picloram / Trichlopyr (Butoxyethyl ester)	Aquatic toxicity of butoxyethyl ester of triclopyr and mobility of picloram
Garlon 3A	464-546	Triclopyr (Triethanol amine salt)	Triclopyr may be classified as a class C carcinogen, and is both moderately mobile and persistent
Tordon K	464-421	Picloram	Mobility of picloram as a broadcast spray
Weedone 170	264-222	2,4-D (Butoxyethanol ester) 2,4-DP (Butoxyethanol ester)	Aquatic toxicity of butoxyethanol ester of 2,4-D

Carol Rowan West

Carol Rowan-West, Director
Office of Research and Standards
Department of Environmental
Protection

April 30, 1997
Date

Brad Mitchell

Brad Mitchell, Chief
Pesticide Bureau
Department of Food and
Agriculture

4/18/97
Date

SENSITIVE AREA RESTRICTIONS (333 CMR 11.04)

Sensitive Area	No-Spray Zone	Limited Use Zone
Wetlands	10 feet	10 - 100 feet selective low pressure stem treatments
Public Ground Water Supply Wells	400 feet	Zone II (Primary Recharge Area). 24 months must elapse between application; selective low pressure stem treatments.
Public Surface Water Supplies	100 feet	100 - 400 feet 24 months must elapse between application; selective low pressure stem treatments.
Private Water Supplies	50 feet	50 - 100 feet 24 months must elapse between application; selective low pressure stem treatments.
Surface Waters	10 feet	10 - 100 feet 12 months must elapse between application; selective low pressure stem treatments.
Agricultural and Habitated Areas	----	0 - 100 feet No high pressure foliar applications; 12 months must elapse between application; selective low pressure stem treatments.

HERBICIDES FOR USE ON SENSITIVE AREAS

Trade Name	EPA#	Active Ingredient(s)	Guidelines
Arsenal	241-273	Imazapyr	3 pints/acre every 3rd year, or 2 pints every other year.
Accord	524-326	Glyphosate	None
Banvel CST	55947-32	Dicamba	Sponge application to cut stump.
Escort	352-439	Metsulfuron methyl	None
Garlon 4	464-554	Triclopyr (Butoxyethyl ester)	0.5 pints/acre
Krenite	352-376	Fosamine Ammonium	None
Krenite S	352-395	Fosamine Ammonium	None
Rodeo	524-343	Glyphosate	None
Roundup	524-308	Glyphosate	None

Appendix E: DEM Request Forms for Jurisdictional Inspection of a Dam

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

P.O. BOX 173, OLD COMMON RD., LANCASTER, MA 01523 PHONE ~~978~~ 508-792-7716
FAX 792-7718

REQUEST FOR JURISDICTIONAL DETERMINATION AND/OR INSPECTION.

Argeo Paul Cellucci
GOVERNOR

Trudy Coxe
SECRETARY

Peter C. Webber
COMMISSIONER

TO: OFFICE OF DAM SAFETY
P.O. BOX 173
OLD COMMON ROAD
LANCASTER, MA 01523

ATTN: ____________________

IN ORDER TO ASSIST THE DAM SAFETY OFFICE IN ISSUING A DETERMINATION OR SCHEDULING AN INSPECTION, ALL DAM OWNERS ARE REQUESTED TO PROVIDE THE FOLLOWING INFORMATION TO THE BEST OF THEIR ABILITY. PLEASE CALL THE OFFICE OF DAM SAFETY IF YOU REQUIRE ASSISTANCE IN COMPLETING THESE FORMS.

1. GENERAL DATA

A. YOUR NAME: ____________________

ADDRESS: ____________________

TOWN/CITY: ____________________

STATE: __________ ZIP CODE: __________ TELEPHONE: ____________________

B. DAM OWNER'S NAME(S): ____________________
IF SAME AS ABOVE CHECK HERE: ______

ADDRESS: ____________________

TOWN/CITY: ____________________

STATE: __________ ZIP CODE: __________ TELEPHONE: ____________________

C. DAM CARETAKER'S/CONTACT PERSON(S) NAME(S): ____________________
IF SAME AS ABOVE CHECK HERE: ______

ADDRESS: ____________________

TOWN/CITY: ____________________

STATE: __________ ZIP CODE: __________ TELEPHONE: ____________________

D. NAME(S) OF DAM: ____________________

STATE ID NO: ____________________ NATIONAL ID NO: ____________________

E. LOCATION OF DAM

1. TOWN/CITY: ____________________

2. NAME OF IMPOUNDMENT (LAKE, POND, RESERVOIR, ETC) AND/OR NAME OF RIVER/STREAM OR

TRIBUTARY NAME: ____________________

printed on recycled paper

3. DETAILED DESCRIPTION OF LOCATION. PLEASE ATTACH LOCUS MAP AND/OR DIRECTION/ACCESS ROAD(S), STREET(S), ETC:____

____

4. NAME OF U.S.G.S. MAP QUADRANGLE :__________________________________

5. LATITUDE:________________________ LONGITUDE:________________________

6. IS THERE A FREE ACCESS TO THE DAM? DESCRIBE THE NATURE OF SECURITY DEVICES (GATES, FENCES, GUARD DOGS, ETC):____

____

F. WHAT PURPOSE DOES THE DAM SERVE:____________________________________

2. DESCRIPTION OF DOWNSTREAM DEVELOPMENT WITHIN THE APPROXIMATE WIDTH OF AFFECTED FLOOD PLAIN.

PLEASE CHECK THE APPROPRIATE ITEMS:

	MILES DOWNSTREAM FROM DAM									
DOWNSTREAM DEVELOPMENT	TO 1/4	1/4 TO 1/2	1/2 TO 3/4	3/4 TO 1	1 TO 1-1/4	1-1/4 TO 1-1/2	1-1/2 TO 1-3/4	1-3/4 TO 2	2 TO 2-1/4	2- 1/4 TO 2-1/2
OCCUPIED HOME(S)										
UNOCCUPIED HOME(S)										
COMMERCIAL BUILDING(S)										
AGRICULTURAL BUILDING(S)										
SCHOOL(S)										
HOSPITAL(S)										
HIGHWAY(S), ROAD(S), BRIDGE(S), CULVERT(S)										
RAILROAD(S), & RAILROAD(S) BRIDGE(S)										
DAM(S)										
OVERHEAD UTILITIES										
UNDERGROUND UTILITIES										
OTHER INFRASTRUCTURE/FACILITIES NAME:__________										
OTHER INFRASTRUCTURE/FACILITIES NAME:__________										

COMMENTS (REFER TO SPECIFIC ITEM, IF APPLICABLE) :

1. PHYSICAL DATA

PLEASE ESTIMATE THE FOLLOWING:

A. TYPE OF STRUCTURE (EARTH, CONCRETE, ETC.):__________

B. YEAR COMPLETED:__________

C. MAXIMUM STRUCTURAL HEIGHT(ft):__________

D. SIZE OF IMPOUNDMENT(acres):__________

E. AVERAGE DEPTH OF IMPOUNDMENT(ft):__________

F. DRAINAGE AREA(sq.mi.):__________

G. CREST LENGTH(ft):__________ CREST WIDTH(ft):__________

H. NATURE OF SLOPE PROTECTION (RIPRAP, VEGETATED, ETC.):__________

I. SPILLWAY INFORMATION

1. TYPE OF PRIMARY SPILLWAY, i.e. OVERFLOW WEIR, DROP INLET, CULVERT, ETC., PROVISIONS FOR STOP LOGS/FLASH BOARDS:__________

a. DIMENSIONS/SIZE(ft):__________

b. CAPACITY(cfs):__________

2. TYPE OF EMERGENCY SPILLWAY:__________

a. DIMENSIONS/SIZE(ft):__________

b. CAPACITY(cfs):__________

J. LOW LEVEL OUTLET(S) INFORMATION

1. TYPE(S) OF LOW LEVEL OUTLET(S):__________

a. DIMENSIONS/SIZE(ft):__________

b. CAPACITY(cfs):__________

4. WHAT IS YOUR DETAILED REASON FOR REQUESTING THIS INSPECTION:

____

____

____

5. COMMENTS(REFER TO ITEM NO, IF APPLICABLE):__________

____

YOUR SIGNATURE:__________ DATE: __________

USE THE FOLLOWING ABBREVIATIONS:N.A.- NOT AVAILABLE, N.APP.- NOT APPLICABLE, N.O.- NONE OBSERVED, UK - UNKNOWN
(REV. SEPT. 1997)

Appendix F: DEM Request Forms for Dam Repair Work

Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Management

APPLICATION FOR AUTHORIZATION TO CONSTRUCT OR ALTER A RESERVOIR, RESERVOIR DAM OR MILL DAM.

P.O. Box 173
Old Common Road
Lancaster, MA
01523
(508) 792-7716
FAX 792-7718

**Office of
Dam Safety**

Jurisdiction: M.G.L. Chapter 253, s. 44 et seq. as amended by Chapter 706 of the Acts of 1975 and Chapter 720 of the Acts of 1979; and in accordance with 302 C.M.R. 10.00 - Dam Safety Rules and Regulations:

The approval of the Commissioner shall not apply to small dams, constructed for irrigation or for other purposes, the breaking of which would involve no risk to life or property, nor to standpipes or tanks nor to a dam where the area draining into the pond formed thereby does not exceed one square mile; unless the dam is more than six feet in height above the natural bed of the stream at any point, or unless the quantity of water which the dam impounds exceeds one million gallons. However, information must be submitted to enable the Commissioner to determine whether approval is necessary.

Approval of this plan does not release the applicant from the requirements of Massachusetts General Laws Chapter 91, or Chapter 131.

Part "A"

JURISDICTIONAL DETERMINATION
(Check the appropriate column)

1. Is there a risk to life and property downstream in the event of failure ? Yes( ) No( )

2. Does the area draining into the pond exceed one square mile ? Yes( ) No( )

3. Does the height of the dam exceed six (6) feet above the natural bed of the stream at any point ? Yes( ) No( )

4. Does the volume of water impounded at maximum pool level exceed one million gallons ? Yes( ) No( )

If the answer to any one of the above questions is Yes, then the Commissioner of the Department of Environmental Management has jurisdiction. Proceed with Part "B" of this application.

If the answers to all four of the above questions is No, please submit backup information for review by this Department for our jurisdictional determination. The backup information should include at least the following:

(a) a copy of a topographic map clearly indicating the location of the dam and effective drainage area,

(b) a sketch showing the maximum section of the dam indicating its height, as measured from the lowest point;

(c) calculations for the volume of water impounded at the maximum design pool level,

(d) a brief statement pertaining to downstream conditions with respect to risk to life and property,

(e) the signature of the applicant and a registered professional civil engineer.

Part"B"

GENERAL INFORMATION

1. Location (city/town):______________________________

2. Detailed description of dam location:

____

____

____

____

____

____

____

____

____

3. Present or prospective owner(s):

Name(s): ____________________

____

Street: ____________________

____

City/Town: ____________________

State: ________ Zip Code: ____________________

Telephone: ____________________

4. Name of U.S. Geological Survey map quadrangle:

____

5. Name of reservoir or waterway: ____________________

6. Is there specific legislative authority to construct the dam ?

( )yes ( )no Identify: ____________________

7. Purpose of the dam: ____________________

____

____

8. Nature of work to be performed:

( ) proposed dam,

( ) alteration of existing dam,

( ) major repair of existing dam,

( ) regular maintenance (if checked, go to Part "C").

HAZARD EVALUATION

(Downstream Field Investigation)

1. The estimated number of people that could be affected by overtopping or failure of the structure, and to what degree they would be affected:

____

____

____

____

2. The number of properties (homes, buildings, etc.) affected and the estimated extent of damage by overtopping or failure:

____

____

____

____

3. Roads (specify type) or other structures that could be affected by overtopping or failure:

____

____

____

____

4. Additional Information:

____

____

____

____

HYDROLOGIC CONSIDERATIONS

Procedures for hydrologic design as contained in the latest edition of the U.S. Department of the Interior, Bureau of Reclamation's "Design of Small Dams".

1. Peak Outflow: ____________________ (C.F.S.)
2. Design Storm Duration: ____________________
3. Rainfall Intensity: ____________________ in./hr.
4. Percent Runoff: ________ % ________ inches
5. Contributory Drainage Area: ____________________ sq. mi.
   (Attach a copy of the U.S. Topographic Map with the outline of the drainage divide.)
6. Previous Known Flood of Record:

   ____________________ month/year
7. Design Maximum Flood Level Elevation: ____________________
8. Additional Information:

   ____

   ____

   ____

   ____

DESIGN CRITERIA

1. Datum used:

   (a) M.S.L. of 1929________________

   (b) Assumed________________

   (c) Other________________

2. Maximum height of the dam (ft.):________________

   (a) Top elevation of dam:________________

   (b) Top elevation of spillway:________________

3. Volume of water impounded at maximum design pool level:

   ________ gallons

4. Present river bed or channel elevation @ dam:________________

5. Normal pool elevation:________

   Surface area:________ac.

6. Maximum pool elevation:________

   Surface area:________a.c.

7. Type of structure (earth, concrete, etc.):

   ____

8. Crest width:________ft.

9. Freeboard, as measured from the maximum design pool level:

   ____

10. Length of principal spillway:________

11. Description of principal spillway:

    ____

    ____

12. Emergency spillway: ( )Yes ( )No

If yes, describe:

____

____

13. Gates: ( )yes ( )no
If yes: Number__________ Size__________

14. Nature of slope protection (riprap, vegetation, etc.):

____

15. Stoplog structure(s):

Yes ( ) : Mechanical ( ) Manual ( )

No ( )

SUBSURFACE INVESTIGATION

Boring logs, analysis and recommendations to accompany this application.

CONSTRUCTION DRAWINGS

Names and addresses of property owners for all parcels of land within the flowage area must be clearly indicated on the plan. Submit two copies with this application.

SIGNATURE SECTION

APPLICANT:

Name————————————————————

Street————————————————————

City/Town——————————State————Zip————

Telephone——————————

SIGNATURE:————————————————————

DATE:——————————

DESIGN ENGINEER:

Name————————————————————

Street————————————————————

City/Town——————————State————Zip————

Telephone——————————

SIGNATURE:————————————————————

DATE:——————————　ENGINEER'S STAMP:
(must be included)

Upon receipt of this required application, a prompt determination will be made on issuing a permit to proceed. Conditions of such a permit will be contingent upon the nature of the proposed work.

Part "C"

REGULAR MAINTENANCE

If the proposed work involves regular maintenance activities (i.e. the proposed work does not materially alter the dam), a permit is not required.

Typical maintenance activities include, but are not limited to, the following items.

Please indicate the nature of proposed maintenance and return the completed application. Use additional paper if necessary.

	YES	NO
Surface cracks?	( )	( )
Slumping or cracking on the upstream or downstream side?	( )	( )
Erosion from runoff, ware action, or traffic?	( )	( )
Embankment/spillway seepage?	( )	( )
Muddy water?	( )	( )
Top of dam settled?	( )	( )
Loss of riprap?	( )	( )
Trees, brush or burrows on embankment?	( )	( )
Spillways blocked?	( )	( )
Exposed metal rusted?	( )	( )
Concrete deterioration or cracks?	( )	( )
Cracks or uneven movement?	( )	( )
Scour?	( )	( )
Pipe joint separation?	( )	( )
Gates operational?	( )	( )
Trash racks blocked?	( )	( )

LOCATION OF PROPERTY

Location (city/town):____________________

Registry of Deeds (city/town):____________________

Book__________ Page__________

Locus Map - please attach.

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